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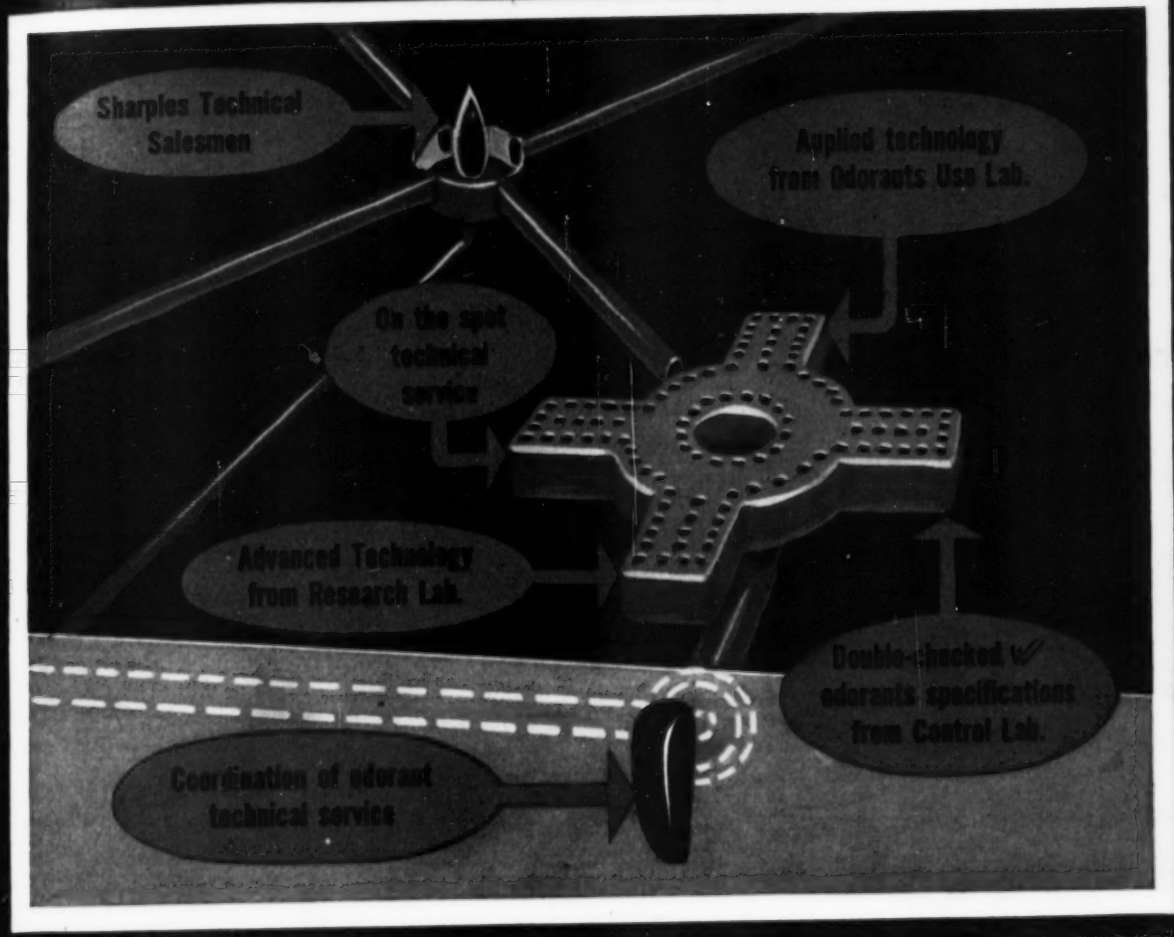
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GAS

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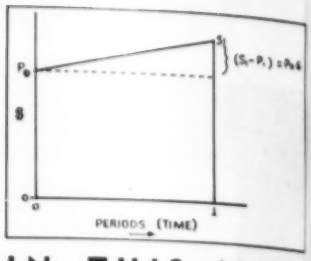

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Basic aspects of correct economic analysis are taken into consideration in the first part of an article on the economics of cathodic protection appearing on pages 48-53.

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Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

Reserves hit 211.4 trillion

Increasing 11.7 trillion cu ft 1952's estimate, natural gas reserves as of Dec. 31, 1953 stood at 211.4 trillion cu ft, according to the latest annual report of the AGA-API committee on reserves. This was the largest gain in any year since 1946 (see page 84 for complete statistics).

Sixteen gascos termed "excellently managed"

Sixteen gas utilities, holding companies, and combination companies have been named to a select list of 348 "most excellently managed concerns" in the United States. The American Institute of Management's newly published "Manual of Excellent Managements" lists El Paso Natural Gas Co., Lone Star Gas Co., Oklahoma Natural Gas Co., and Portland (Ore.) Gas & Coke (see GAS, Sept., page 39), among straight gas utilities; Cincinnati Gas, Commonwealth Edison, Consolidated Gas of Baltimore, Consumers Power Co., Detroit Edison, Iowa-Illinois Gas, Kansas Power & Light, Montana Power, Pacific Gas & Electric, and Pennsylvania Power & Light among combination companies. Holding companies honored included General Public Utilities Corp. and Pacific Lighting Corp.

Trans-Canada optimistic over permit prospects

The new company, an amalgamation of the original Trans-Canada and its prospective competitor, Western Pipe Lines Ltd., expects Alberta to issue export permits for it to carry gas to the eastern provinces shortly. No opposition is anticipated from the Federal Board of Transport Commissioners in Ottawa, either. Engineering work would begin immediately after approval is given.

59 million in 5 years?

The AGA's bureau of statistics says that's how many ranges, water heaters, and heating units can be sold from 1954 through 1958—if economic conditions remain at present levels. Actual sales, 1948 through 1952, reached 36.3 million. At the 1953 level of consumer disposable income, range sales alone in 1953 would reach 3,150,000 units, and for the five year period ahead would total 19,300,000. Range sales in 1948-52 totaled 12,418,000; but an increase is expected "because of improvement expected in consumer acceptance of gas resulting from increased promotion and production design activity," says AGA. Gas water heater sales potential for the next five years is 18 million, including 2.6 million units in 1954. Gas dryer potentials are 200,000-225,000 for 1954; incinerators should run 160,000-200,000, says AGA.

Piping and appliance standards being readied

Manufacturers have received from the AGA Lab review copies of Recommended Revisions to American Standard Installation of Gas Piping & Gas Appliances in Buildings. Criticisms or endorsements are due now for further consideration by the standards committee.

Ohio banks on Gulf to "unfreeze" heat load

PUCommisioner Ray Martin of Ohio is optimistic that the gas house-heating situation in the state next winter will be the best since the allotment regulations were first put on in 1947. The Gulf Interstate line, originally scheduled for completion in November or December, should be ready to start supplying gas by early fall, in time for the heating season. PUC recently "unfroze" 20,000 applications for gas heat.

An Eye on the Capital

Storage bill may pass

This early spring is a time of unusual legislative activity on Capitol Hill in relation to the natural gas industry, and it has been a long time since committees and the Congress as a whole seemed to move with such dispatch.

The Dirksen bill (S. 525), authorizing the use of eminent domain in obtaining underground formations for the storage of natural gas, was the subject of Senate committee hearings recently. It seems fairly certain to be reported by the Purtell subcommittee of the Senate Interstate and Foreign Commerce Committee and may be passed by the Senate before adjournment.

The subcommittee is trying to determine whether or not the Natural Gas Act should be amended specifically, as has been urged by the Federal Power Commission, the Department of the Interior, and the natural gas industry through the Dirksen bill.

FPC Chairman Jerome Kuykendall noted that (1) the amendment does not limit "storage" to "underground storage," (2) it should be limited to storage of natural gas, and (3) eminent domain authority should be exercised only with respect to matters covered by a certificate of convenience and necessity issued by the FPC.

The Natural Gas Pipeline Co. of America offered amendments to protect the interests of owners lying within the boundaries of a proposed storage area (or of owners of mineral rights) to explore for and to produce oil or gas. On another angle, J. French Robinson, president of the Consolidated Natural Gas Co., stated:

"If storage were not developed, the industry would be forced either to make

Thermally Thinking

larger and larger off-peak sales of dump gas or to greatly expand its transmission facilities with consequent increase in rates." He noted that the bill, as written originally, "was broad enough to condemn interest in a field already being used for storage by another producer, the storage capacity of which may already be devoted to the public interest . . ."

Congress is off the hook

There is constant conversation here —during the coffee hour at FPC, or at the Statler or Mayflower bars, where the lobbyists and the lawyers gather— about the possibilities of what the U. S. Supreme Court will do on the now-famous (and historic) Phillips case.

The court's almost-unprecedented action in agreeing to review the Phillips case (after refusing to do so only a few weeks before) was greeted with great relief by the FPC, which now has more time to consider practical ways and means for exercising jurisdiction if this eventually is required. Authoritative sources here said that no FPC official approached any member of the Supreme Court during the period between the time the court said it wouldn't and then said it would review the Phillips case. But a campaign of careful education—to show members of the court what a far-reaching effect the first decision had on FPC's potential workload—was carried out, as carefully as protocol allowed.

The producers and the producing states likewise now will have an opportunity to make plans for future contingencies, since the court has decided to review the case. And, important on Capitol Hill, Congressmen from both producing and consuming states are now off the hook, so to speak, and do not have to take up controversial, remedial legislation in a crucial election year.

"Champions of the consumer" are at it again

Meantime, two New Dealing senators introduced bills—both of them slated to be pigeonholed, in all likelihood—that would affect the natural gas industry, if ever enacted.

Sen. Guy M. Gillette (D., Ia.) resurrected a bill which he and the late Senator Tom Borah (R., Ida.) first introduced back in 1939, shortly before Senator Borah's death. He told the Senate his measure would save $18 million a year for farmers and other people in Iowa alone and a still more "tremendous sum for people throughout the nation."

The bill would forbid interstate common-carrier pipelines to transport oil in which their owners have "any interest." Thus, he said, it would "place these pipelines under the same regulations as now govern railroads."

The Iowa senator explained it like this: The Hepburn Act, passed in 1906, contains a "commodities clause." This, in the original version of the act, forbade both railroads and pipelines to carry products made or mined by companies they owned, but the pipeline part of it was knocked out.

"It is long past time for the oil pipelines to be required to operate truly as common carriers, so the benefits from this lower-cost mode of transportation may be passed on to consumers instead of being retained as part of the profits of the big companies which own the pipelines."

The action of Sen. Hubert H. Humphrey (D., Minn.) in introducing S. 2971 to defer for 15 months, instead of five, the time period before proposed natural gas rates go into effect was motivated by the experience of Minnesota cities (consumers) with gas supply rate changes.

The Humphrey idea is to prevent pyramiding of rate increases as a result of applications repeatedly filed by natural gas companies for new (and higher) rates, before the FPC has determined what to do about pending applications.

The senator says that there have been periods of time in which consumers of natural gas have been paying successive increases, later found by the FPC and the courts in some areas to be higher than they should be. Refunds have been made, but the senator says that some people couldn't afford to have even a little extra money tied up like this.

Besides deferring for 15 months the time period before new rates may go into effect, Humphrey's bill also would give the commission authority at any time within 30 days after the filing of a new rate schedule to order an interim rate, charge, classification, or service to become effective for 15 months.

Incidentally, while Senators Gillette, Humphrey and Douglas all are in the "minority" now, and, of course, likely to see their bills pigeonholed, all of them are up for election this fall, and, if re-elected and the Senate control changes hands (as seems probable, to say the least), will be in a position to push their legislative proposals. That's why, even if these bills now are going to sleep a while, it is important to know about them. Elections are not far off.

Hinshaw bill passes

The Senate has passed and sent to the White House a bill to exempt natural gas companies doing business within a state from Federal regulation.

Passage was by voice vote after the Senate rejected, 52 to 25, a motion by Sen. Morse (Ind., Ore.) to send the measure back to the Senate Commerce Committee to hold hearings.

The committee reported the bill to the Senate last July, without hearings, the same day the House approved it.

The Senate also turned down, by voice vote, a substitute bill by Sen. Paul H. Douglas (D., Ill.). Douglas and Morse asserted the bill was intended to whittle away more of the Government's power to regulate gas rates in the public interest.

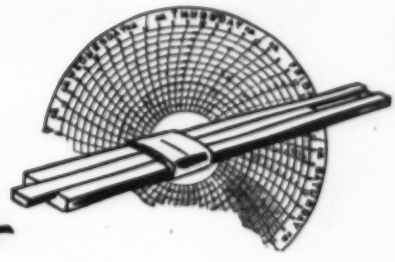
Ohio's two senators clashed sharply on the measure's effect on consumers.

Chairman John W. Bricker (R.) of the Commerce Committee said it would eliminate duplicate regulation of local firms. He said state regulation was enough.

Sen. Thomas A. Burke (D.) insisted the result would be to add "millions" to customers' gas bills. Sen. Francis P. Case (R., S. D.) also thought it might lead to higher costs.

By the time this is in print, the President will likely have signed it. However, since a Democratic-dominated Supreme Court in 1950 initiated the fight, the action may be used this fall by the Democrats as additional evidences of the mythical Republican desire to favor big business at the expense of the consumer.

Technical Trends



• By GUY CORFIELD

Synthetic fuel program cut

A long and heated argument between the government and the oil industry appears to be over with the announcement by the Secretary of the Interior that the Bureau of Mines will confine its synthetic fuel work—liquid fuels and gas from coal, and similar products from oil shale—to the laboratory and small pilot plant scale. Previously the Bureau of Mines had asserted that oil supplies were to the point where synthetic substitutes would soon be required, and full-scale government plants should be constructed to immediately develop practical fuel know-how, and the petroleum industry had vigorously protested that no such shortage was imminent and in any event is technically and financially equipped (if let alone by government) to go in to substitute fuel production when and if it becomes necessary.

This step may indicate changing philosophy of government, or an upward revision in estimates of petroleum reserves—or possibly both.

Free piston engine

The free piston engine attained practical development in Europe prior to World War II and during that war was used for auxiliary power on German submarines. It has since stirred increasing interest in the U. S. and is being designed for such applications as electrical generation and fluid pumping.

As could be deduced from its name, its pistons are not connected to moving parts such as crankshaft and fly wheel, but instead it is made up essentially of two opposing pistons mounted in a single cylinder. Fuel is injected into the space between the two pistons and, upon ignition, the two pistons are forced apart so as to compress air at the outer ends of the cylinder. This compressed air flows back through the firing chamber (between the two pistons) sweeping out the hot combustion products, and the resulting hot mixture of air and combustion products are forced out of the engine. The two pistons are then returned to their original position by the spring action of the cushion of compressed air at the ends of the cylinder, completing the scavenging of the combustion area and trapping and compressing some clean air. More fuel is then injected between the pistons, and the cycle is repeated.

The net product of the engine, heated air and combustion products under pressure, can be applied in a variety of ways such as through a gas turbine to drive a centrifugal compressor. While this engine is in some respects similar to a diesel, it is unlike it in that the length of the stroke or total movement of the pistons is not fixed mechanically, but varies with the amount of fuel used and the pressure of the air cushion. It is practically free from vibration, is relatively light and small, has very few moving parts and is said to have higher efficiency of fuel conversion than a diesel engine or a steam power plant.

Deeper and deeper

The world's record for depth of oil well drilling is presently held by California. The deepest well is Ohio Oil Co.'s 72-4 KCL in the Paloma field of Kern county, now down to 21,482 ft —slightly more than *four miles!* The deepest regularly producing well is operated by Richfield Oil Co. in the North Coles Levee field, also of Kern county, and flows 119 barrels per day from a depth of 17,892 feet.

Other deep wells are at Weeks Island, coastal Louisiana (Shell Oil Co.), 17,306 feet; at Eddy county, southeastern New Mexico (Richardson & Bass Co.), 16,705 feet; and West Texas (Gulf Oil Corp.), 16,696 feet.

Incidentally, the oil industry's program for 1954 includes 48,410 new wells, slightly less than 1953; and the U. S. requirements for 1954 are estimated to exceed 8 million barrels of oil daily, about 5% above 1953.

Nickel-cadmium battery

The Sonotone Corp. of Elmsford, N. Y., is now commercially producing a battery for which almost unbelievable characteristics are claimed. It is composed of pairs of plates made by sintering carbonyl nickel powder on nickel wire screens, the positive plate being impregnated with nickel salts and the negative with cadmium salts. The electrolyte is potassium hydroxide, which does not combine chemically with the nickel or cadmium components. Terminals are made of nickel and the cases can be plastic or stainless steel, depending on the required strength. Each cell has an output of 1.30 volts, and can be closely spaced to provide large capacity for small overall size.

Discharging and charging can be done at exceedingly rapid rates; 100 amps can be drawn steadily for short periods from cells having a capacity of only 3 amp hours, and a completely discharged battery can regain 80% of its full charge in 15 minutes; damage from overload, or even reverse charge, is not encountered. On one test, 3000 cycles of charge and discharge reduced the battery capacity only 10%; no change in capacity is produced by leaving the battery idle, either charged or discharged, over a four-hour period; in one year's time a charged battery lost only 40% of its charge. Satisfactory operation is obtained at temperatures between 165 and -65°F. The battery can be placed in any position, is resistant to shock and vibration, and need have only a little water added once a year. It would seem that such a battery, even though very costly, would have superior use for special standby power applications, communication purposes, portable instruments, etc.

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Part 1 • Setting up a cost reduction program

Cutting costs in the distribution department

By **GEORG BABBE,** Staff Engineer • Southern California Gas Co., Los Angeles

The problem

DO YOU have a piece of graph paper handy in your desk? Fine. Get it out, will you, please—I'd like to have you help me do some stage setting.

First, along the base, take some convenient scale for marking off the last 10 years, 1944 through 1953, left to right. Then plot for each year the hourly wage you paid on the average during that year for, say, a welder or a fitter. Do the same thing for the price during each year of a foot of 2-in. steel pipe. And for the price of a new service truck. Here you have a crude but a very effective index of the cost of running a distribution department: price curves for distribution labor, materials, and equipment.

Frankly, this little exercise in applied statistics is not intended to startle you with some little-known facts about your business. The fact that the price of every component of distribution operations has been sky-rocketing during the past several years certainly does not come under the heading of a news flash. The upward slope of each of these price curves does represent, however, a very specific and close-to-home challenge to anyone responsible for the management or supervision of distribution activities.

It is not very likely that hourly wage rates will drop in the near future or that significant reductions will be made

• This is the annual distribution issue

Eleven hundred gasmen will meet in Montreal April 20 through 23, with one subject uppermost in their minds—distribution (and the allied fields, motor vehicles and corrosion). Special features in this issue of GAS magazine are built around three basic aspects of the subjects. They are: cost cutting in distribution work, truck standardization, and the economics of corrosion protection.

GAS exclusive

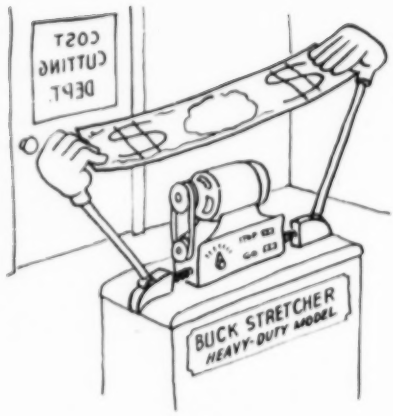
in material or equipment prices. As a matter of fact, the trend still seems to be upward, although at a slightly slower rate. What can be done, then, to maintain or reduce the cost of installing a foot of pipe in the distribution system? In this and subsequent articles, one possible answer to this question is presented: a cost reduction program for your distribution department.

What are we talking about?

First, let's define terms. By a cost reduction program I mean a planned and systematic campaign to increase the value received for every dollar spent on distribution activities. I do *not* mean a short-term, expense-cutting project involving deferment of necessary work.

Such a project may be necessary under extreme conditions, but it all too frequently results in "savings" that are in reality little more than bookkeeping transactions and which may actually represent increased costs in the long run. An effective cost reduction program is a long range, positive undertaking that continues to generate benefits as the program progresses.

This definition is admittedly a broad one. Any number of overall company functions will contribute to increasing the value of the distribution dollar: an effective personnel selection and training program, for example; sound purchasing and stores operations; realistic engineering and design standards. Let's forego the pleasure of discussing how other departments should be operated, however, and concentrate on a cost reduction program that can be developed and administered within the distribution department itself. Specifically, what can be done to increase the value of each dollar spent on field construction and maintenance operations—the



installation and repair of the distribution pipeline system?

I don't mean to imply that this is a new question, suddenly facing distribution management for the first time. Review the proceedings of the various gas industry associations and you will see how keenly aware distribution supervisors are of the importance of reducing costs and how effective their efforts in this field have been. It is such a basically important question, however, that I believe it should be asked periodically and consideration should be given to possible solutions beyond the scope of day-to-day supervisory assignments.

The cost reduction program presented in this series is one such solution. This first article discusses the organization and development of a cost reduction program. The second will present some specific examples of the results obtained through such a program, indicating opportunities for significant savings in pavement breaking, excavating, meter assembly construction costs, etc. The third article describes the administration of construction planning, work standards, and cost-control activities that extend the benefits of a cost reduction program on a long range basis.

Why a "program"?

If your department's supervisors have been working hard to keep costs in line, you might very well ask, why superimpose a cost reduction program on their regular assignment? Won't there be friction and possible duplication? Not in an effective cost reduction program. Such a program will supplement, not duplicate, the day-to-day cost reduction efforts of operating supervisors.

The "program" approach offers several distinct advantages. In the first place, it clearly indicates top management's interest and support. It spells out the objectives that management has in mind and clarifies the operating supervisors' responsibility for attaining these objectives. Furthermore, a planned program generates the same beneficial publicity that a safety campaign obtains—cost reduction opportunities that might be overlooked in the press of day-to-day operations are more likely to receive the consideration they deserve. Conversely, the "old Spanish custom," the operation or method that "everybody knows is necessary" is subject to the harsh light of group attention and frequently turns out to be nothing but a habit—a bad one at that.

Aside from these psychological benefits, a sound cost reduction program, as discussed in more detail later, entails some person or group being relieved of regular assignments and charged with the broad evaluation of current operations and methods in terms of possible improvements. The different perspective, the fresh outlook of a person on such an assignment frequently reveals opportunities for savings that are likely to be overlooked by someone so close to the operation that he "can't see the forest for the trees."

George Babbe, who has a BS in business administration from Northwestern University, joined Southern California Gas Co. in 1949 as a time study analyst, after doing industrial relations work for Minnesota Mining & Manufacturing Co. and C. F. Braun & Co. He has been, successively, supervisor of the distribution training department and staff engineer in the distribution department. His present duties entail general supervision of the department's work measurement, budget and cost control, and contract administration.

Getting a cost reduction program underway

How would a cost reduction program be instituted? The first step is to make sure that such a program is actually desired. This may seem strange—surely everyone views high costs in the same light as sin—i.e., we're "agin it." There are two sides to every coin, though, and a cost reduction program—like purity—presents certain disadvantages that should be clearly recognized. First and foremost, such a program costs money. It not only costs money to set up and administer, but the program may generate recommendations that require a substantial immediate capital outlay to reduce long range operating costs: a new piece of construction equipment, for example. Unless the ultimate potential savings are great enough or its current financial status sound enough, an organization may very well conclude that it can't, at the moment at least, afford to save money.

Secondly, an effective cost reduction program requires considerable time and attention on the part of operating supervisors and management. If the program is as thorough and searching as it should be, it will generate controversial recommendations that will require a good deal of thought and discussion to settle. This additional burden imposed upon key personnel should be fully recognized.

Third, a cost reduction program can be an embarrassing and disquieting activity. Widely accepted procedures may prove to be particularly ineffective; a number of individuals' pet theories may be disclosed as expensive luxuries. In short, toes will be stepped on—and they may be your own.

If after due consideration of the dark side of the picture, a cost reduction program still seems to be a desirable project, the following five general steps will help to get it underway on a sound basis. These are presented in the general order in which they would probably be started although, as you will see, they are highly interrelated and work completed in one of the later steps may indicate changes which should be made in earlier ones.

1. Define the scope of the program. There are so many tempting directions in which a newly initiated cost reduction program can be headed that a real danger exists that little will be accomplished as a result of attempting to do

COST CUTTING DEPT
ASSIGNMENT Cut costs here
ASSIGNMENT Trim down there
ASSIGNMENT Eliminate everywhere
ASSIGNMENT Shave some more
ASSIGNMENT Cut at least ½
ASSIGNMENT Trim to essentials
ASSIGNMENT Remove the costly item
ASSIGNMENT Leave only the rest
ASSIGNMENT More of the same

everything. Hence, it's important to decide in advance in what field of distribution activities the program will operate, at least initially. Perhaps the predominant type of work performed currently by your company is maintenance, which would make this the most likely target for cost reduction attention. Or perhaps some specific operation common to many activities, such as excavating, should receive first attention. In any event, the cost reduction group should have a fairly specific first assignment.

Also, the nature of the program's investigations should be determined in advance. Will the group be responsible only for methods and procedures studies, or will it be expected to make time studies in addition as the basis for production standards? Methods studies alone require substantially less time to complete than an entire industrial engineering project and the immediate benefits in terms of improved methods are probably as great. On the other hand, time studies and production standards provide a basis for a continuing review of cost performance, as will be discussed in a later article.

"Blitz" or long term?

The schedule of the program should also be set. Is the program to be a "blitz" affair, with considerable resources thrown behind it in order to accomplish as many benefits as possible in a relatively short time? Or is it to be a long-term activity scheduled as a permanent part of the distribution department's operations? These are questions that top management in the department must answer. As an observation, "one-shot" cost reduction projects have a way of selling themselves as worthwhile continuing activities.

2. Select the personnel who will conduct the cost reduction program. Here's a step that deserves particular attention. The long-term success of the program and its acceptance by operating supervisors will depend largely on the ability and personality of the man or men selected to actually conduct the program. There is certainly no single magic formula for success in this regard. Some old-timers who've grown up in the business have done very well in these assignments—and others have failed miserably. Some youngsters fresh out of school or off the active end of a shovel have also done a fine job—or also failed miserably.

A certain amount of each of four characteristics seems to be important. One is enough experience with distribution operations to have a good working understanding of the activities being reviewed; or, lacking experience, an ability to grasp such an understanding in a short time. The second is an imaginative open-mindedness—a faculty for looking at any particular activity or operation from a fresh and unprejudiced point of view. The third, some reasonable degree of analytical ability—the ability to draw valid conclusions from a wide assortment of data and conversely to avoid coming to conclusions on the basis of only superficially related information. The fourth and perhaps most important characteristic is salesmanship—a knack for getting people to understand and to accept new ideas and new concepts.

Must have time

The man you select for your cost reduction program can be thrice blessed with all these qualities and still fail miserably unless you bestow on him that most essential ingredient: time. A cost reduction program rarely operates successfully on a fill-in or part-time basis. The cost reduction project should be a full-time assignment for the people selected to work on it; they should be completely relieved of all regular duties

during their participation in the program. Incidentally, many companies have found that experience in a program of this type provides excellent training for men being promoted to supervisory or management assignments.

When you put a man on detached duty to work on a cost reduction program, make sure you remember what he's there for. There seems to be a general tendency to use a person on such an assignment for every special chore that comes along. This may be convenient, but remember—it isn't cost reduction.

3. Determine present costs. If you're fortunate, you may already have a fairly good idea of what your distribution operations are currently costing. The accounting systems prescribed by most regulatory agencies, however, are not particularly suited for operating cost control purposes. Consequently, it may be necessary to start your program with an accounting project to determine what your costs are now. This doesn't have to be an exhaustive study to six-decimal-place precision. A generally indicative appraisal of labor and equipment charges will do the job.

Serve two purposes

These bench-mark cost studies serve two purposes. First, they help to focus attention on the specific distribution operations on which cost reduction efforts are apt to be most fruitful—the high unit-cost operations or operations with a big multiplier. Although you may have a good general idea of what your high-cost, high-volume jobs are, a cost survey of this type frequently produces some surprising results. Certain jobs or operations that appear on the surface to be relatively insignificant may actually be costing you much more than would seem possible. An objective cost study assures that each operation gets the attention it deserves.

Secondly, these bench-mark studies provide a basis for evaluating the success of your program. There is only one justification for such an undertaking—the economies resulting from the program should be significantly greater than the cost of obtaining them. If costs aren't being reduced, either the changes resulting from the program's operation aren't effective or they are not being properly applied. Hence, a frequent check on current costs in relation to bench-mark costs provides a means for keeping the program on the ball.

4. Set up procedures for the review, approval and installation of new methods and procedures. In the final analysis, the success of any cost reduction program depends on the manner in which improvements are put into effect. Your cost reduction group may generate some excellent ideas for more economical methods and procedures, but these will prove worthless unless the operating people actually make use of them. Hence, it is particularly important that procedures be set up in advance to assure that recommended changes are reviewed thoroughly, that they are approved by supervisors at a high enough level to ensure that the changes are properly instituted, and that information on the changes—and their approval—is given to the people whose work will be affected.

No vacuum allowed

The cost reduction group can't operate productively in a vacuum—there must be a close and cooperative working relationship between the group and operating supervisors. An effective formal review and approval procedure can be an excellent device for obtaining this relationship. If operating supervisors feel that they have an important part in the program and that their viewpoints are receiving full consideration—even though they are not personally involved in the development or trial evaluation of new methods—they are much more likely to accept the resulting changes and to put them into operation on a sound basis.

One means of accomplishing this is to establish a review group of first-line supervisors, charged with the evaluation of all recommendations made by the cost reduction group. If your organization is large enough, you might consider rotating such an assignment among all these supervisors so that each has an opportunity to participate without having to devote too much time to the activity.

This method of review offers two advantages. In the first place, it assures the soundness of any new methods or procedures which are instituted since the supervisors who will be responsible for using them have personally investigated them. And believe me, their appraisal will be critical.

Secondly, this form of review smoothes the path for actual installation of new methods and procedures. The supervisors who have reviewed and endorsed the changes have a personal

interest in seeing them work. The detailed information on which proposed changes are based and which they receive as part of the review procedure also puts them in a better position to intelligently install the new methods.

Formal review and approval by higher-level supervisors or department management is a worth-while additional check on the general soundness of the cost reduction group's recommendations. This not only permits management to keep generally posted on the operations of the program, but it permits a check on the overall suitability of each proposal. From time to time recommendations are made that are sound in their own particular sphere, but that may be completely undesirable because of their effect on other operations or even other departments. A top-level review will permit screening from this point of view.

This, incidentally, illustrates another advantage of a preliminary review by first-level supervisors. Management can consider each proposed change in relation to its overall suitability, without having to spend the time and effort to assure that it is operationally sound in detail.

Procedures should also be established for the actual installation of approval changes. Participation by the cost reduction group in such installation is desirable because it gives the members a direct check on the quality of their work and also makes certain that the change being instituted is actually being made as proposed.

Here, again, is an advantage of a "program" approach to cost reduction activities: Employees who realize their work is not being singled out on a personal and arbitrary basis, but that any changes affecting them are part of a well-publicized program, will be quicker to accept the new procedures. The feeling of group accomplishment that

exists in an effectively presented program of this sore is a definite aid in getting new methods and procedures operating smoothly.

5. Follow up on the results of the program. A successful cost reduction program results in change—change in work patterns, methods, ideas as to the relative importance of jobs and operations, equipment usage, etc. Too frequently these changes are accepted for the moment, but when attention is focused elsewhere there is a tendency to retrogress, to slip back into the old

comfortable ways of doing things. This resistance to change exists even when the new methods are obviously superior to the old—habit and inertia take over unless some positive effort is made to overcome them.

In order to make sure that the apparent benefits of the cost reduction program are actually being obtained, a planned follow-up program should be scheduled. The success of each approval change should be reviewed by actually checking its application in the field in addition to comparing current costs with bench-mark cost. The frequency of such checks should, of course, be related to the relative significance of the operation: a change resulting in major savings might deserve frequent and intensive follow-up; a relatively minor improvement could be checked infrequently and rapidly.

The basic purpose of this follow-up project is to assess the actual value of the cost reduction program. Are recommended changes achieving the potential savings indicated in the original studies? If not, why not? Perhaps a particular proposal has not proved to be as beneficial as originally visualized. Perhaps the operating conditions have changed. Perhaps the proposal has been improperly or inadequately installed. Or—and this often is the case—perhaps the recommended change has been quietly but firmly ignored by the operating group.

In any event, this progress of following up cost reduction recommendations enables management to determine the actual value of the program and to initiate any changes in either the program or the application of the recommendations generated by the program. Too often, attention is focused only on the research and development stages of the program and the application—where the payoff exists—is practically ignored. A lot of good meat goes into the grinder in this way, but no sausage comes out. A follow-up program ensures a proper balance between development and application—it is really the key to cost reduction in fact, as well as in theory.

Summary

In this article we've discussed the general benefits to be gained from a cost reduction program operating within the distribution department, and we've presented one approach to the development and installation of such a program. In the next article, some specific case studies of cost reduction will be presented: examples of savings of as much as 40% in such operations as pavement breaking, excavating, and meter assembly construction resulting from the operation of a cost reduction program.

Specific examples of results obtained through a cost reduction program, indicating opportunities for significant savings in pavement breaking, excavating, meter assembly costs, etc., will be discussed by Mr. Babbe in the second part of his article. In the third article he will discuss activities that extend the benefits of a cost reduction program on a long range basis: the administration of construction planning, work standards, and cost-control activities.

Eight feet of transcripts in Northwest case

AS "chief reader and digester" of transcripts of the Federal Power Commission's Pacific Northwest natural gas hearings for N. Henry Gellert, president of the Seattle (Wash.) Gas Co., J. Wilson Gaw is a busy man these days.

Mr. Gaw, as assistant to the Seattle Gas president, has the daily chore of reading each day's proceedings and preparing a digest.

As of early March, he had read 24,118 pages of typed transcript. The 161 transcripts, one for each day of actual hearing, made a stack nearly 8 ft high and weighed over 200 lb. They represented what approximately 80 witnesses had said in more than 900 hours of hearings.

Also part of the evidence were 530 exhibits, running from a few pages to more than 100 pages each.

Gas is supposed to be a light subject, but the recorded talk about it at the present FPC hearings grows increasingly ponderous. After shifting a couple of hundred pounds of transcripts and exhibits, to check on what a witness said a year and a half ago, Reader Gaw has no need for supplementary exercises to keep his figure trim.

And the transcripts continue to pile up, as the hearings go on.

J. Wilson Gaw, assistant to President N. Henry Gellert of Seattle Gas, attempts to heft a few million words of transcript in the Pacific Northwest natural gas case, while Miss Kay Vellias, filing clerk, balances the stock of documents.

Economics of cathodic protection

By RAY M. WAINWRIGHT, Associate Professor • University of Illinois

GAS exclusive

One of the most successful modern-day means of controlling corrosion on underground and underwater metal structures has been the application of cathodic protection. The metal surface is maintained at some definite potential wtih respect to the surrounding soil or solution, such that the metal forms a cathode. Under these conditions the migration of metal ions from the surface is minimized; and, therefore, pitting and deterioration of the mechanical properties of the metal are also reduced or eliminated.

In analyzing the costs of corrosion, the costs of maintenance programs for metal structures in soils and solutions, and in comparing the costs of alternative corrosion mitigation programs, it is essential that the basic aspects of correct economic analysis be taken into consideration. For this reason the portion of this article to immediately follow sets forth certain elementary principles of interest rates, annuities, sinking funds, and other types of transactions involving money. This material is followed by a discussion of methods of determining costs, and methods of making economic comparisons.

The two discussions outlined above comprise Part I of two articles. Part II, to follow in a subsequent issue, concerns the applying of these ideas and methods to the economic analysis of corrosion and cathodic protection systems, with illustrative examples.

Mathematics of finance

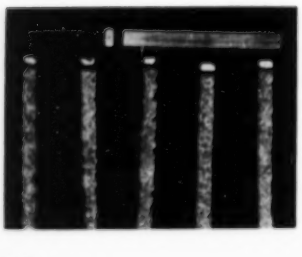
IN ANY transactions involving *money*, it must be remembered that money is itself a special type of commodity. It commands a "price" for its use in the markets of the world in terms of *interest*. Depending upon the point of view, interest may be thought of as equivalent money return on a capital investment, or as an equivalent payment in money for the use of borrowed capital.

The presence of interest may never be ignored in engineering economic analysis, and seldom can be considered as zero in the practical business transaction. The effect of interest is to create a situation such that an amount of dollars, P, at some point in time may never be moved, or considered, at some other point in time, either past or future, without a change in the amount. In *Fig. 1*, for example, if a sum of money, P, is borrowed on Jan. 1, 1950, by Jan. 1, 1955 it has increased to an amount S_1. The change (S_1 — P) is due, of course, to the presence of interest, and will vary in magnitude in some relation to the interest rate. Similarly S_2, in the past, is a smaller sum of dollars than P today. Although S_2 is not equal to P is not equal to S_1, these three amounts could be said to be *equivalent* to each other based on some common interest rate relation.

The idea of *equivalence* as distinct from *equality* in considering amounts of money at different points in time may be illustrated by an example. In *Fig. 2*, five $100 maintenance costs are assumed to occur at five different points in the future as shown. It will be discovered that if the interest rate is 4%

Mr. Wainwright, who is an associate professor of electrical engineering at the University of Illinois, has his BS and MS in electrical engineering. He began his corrosion work when he joined Montana Power Co. in 1936. He later worked on corrosion, metering, and communications at Montana-Dakota Utilities Co. Since 1950 he has been chairman of the cathodic protection subcommittee of the AIEE, is a member of several NACE committees, and is project supervisor of the University of Illinois research project on Criteria for Cathodic Protection.

Coatings, insulating joints, and corrosion control instruments...



will be the main topics of discussion at the Montreal AGA convention April 20-23. This article, in two parts, deals with a more basic problem—economics. The question of how much corrosion protection can cost and still be economical is one that continues to plague management—and engineers who are saddled with the job of proving to management that a sizeable investment today will pay off in reduced maintenance and replacement costs for years to come.

Definitions of symbols

- i = actual interest rate per period (fraction of unity).
- j = nominal interest rate per year (fraction of unity).
- i_e = effective interest rate per year (fraction of unity).
- n = number of periods being considered.
- h = number of periods per year.
- m = number of years.
- P = present sum of money (usually at t = 0).
- S = sum of money (usually at t not equal to zero).
- R = end-of-a-period payment in a uniform series.
- T = beginning-of-a-period payment in uniform series.
- L = salvage value at end of n periods, or m years.
- D = depreciation allowance per year.
- d = discount rate (fraction of unity).
- f = fixed percentage of declining balance in depreciation (expressed as a fraction of unity).

(compound annually), a sum P = $445.20 placed in an interest bearing fund *now*, (t = 0), will be sufficient to pay out the five $100 sums when they occur and leave nothing left over. One can say, then, that in this case $445.20 was equivalent to five $100 payments. The direct sum of the five payments, $500, is an almost meaningless amount in economic analysis. In other words, the direct addition of sums of money which occur at different points in time is not ordinarily permissible.

To facilitate the computation of equivalent sums of money, it is necessary to examine in some detail the more common types of transactions involving money and interest rates. These may be divided for purposes of discussion into two sub-types: (1) Single-payment transactions; and (2) uniform-series transactions. The subscripts "s" and "u" respectively will be used hereafter to designate which type of transaction is being considered. (See accompanying box for other symbols frequently used.)

In computations to follow, interest rates are always expressed as a fraction of unity; thus a 3½% rate is expressed as: j = 0.035.

1. Single-payment transactions

In single-payment transactions interest is computed at the end of each interest-bearing period. In *Fig. 3*, P_o is a present sum of money, bearing interest at the rate of "i" per period. At the end of one period

$$S_1 = P_0 i + P_0 = P_0 (1 + i). \qquad \text{Eq. 1}$$

The accumulated interest is $(P_o i)$, and the total is S_1. It should be noted here that years are not ordinarily used in interest computations; periods are used instead. A period may be a day, a week, a month, six months, a year, or some other useful interval of time. Interest rates are almost always given in terms of "j", the nominal rate per year, and "i" is computed by the simple relation

$$i = j/h \qquad \text{Eq. 2}$$

where "h" is the number of interest-computing periods per year.

If the interest is separated from the principal at the end of each period, and paid, withdrawn, or held apart, leaving the principal unaffected, then the transactions may be graphed as in *Fig. 4*. This is the case with postal savings, for example.

For realistic engineering computations, however, the concept of compounding must enter into the situation. In *Fig. 5*, P_o is a present sum of dollars. After one period this grows to $S_1 = P_o (1 + i)$. In additional periods it grows to:

$$S_2 = S_1 (1 + i) = P_o (1 + i)^2$$
$$S_3 = S_2 (1 + i) = P_o (1 + i)^3$$
$$S_4 = S_3 (1 + i) = P_o (1 + i)^4$$
$$S_5 = S_4 (1 + i) = P_o (1 + i)^5$$

In fact, the basic compound interest factor may be deduced from the above expressions:

$$S_n = P_o (1 + i)^n \qquad \text{Eq. 3}$$

The term $(1 + i)^n$ also equals $(1 + j/h)^{mh}$ from previous definitions. This term is called *compound amount factor* of the single-payment transaction:

$$CAF_s = (1 + i)^n \qquad \text{Eq. 4}$$

Suppose it were required to determine a present sum which would grow to an amount S_n in n periods. Equation 3 could then be inverted to solve for P_o:

$$P_o = S_n \left[\frac{1}{(1 + i)^n}\right] \qquad \text{Eq. 5}$$

The term in brackets is called the *present worth factor* of the single-payment transaction:

$$PWF_s = \left[\frac{1}{(1 + i)^n}\right] \qquad \text{Eq. 6}$$

Several examples of the use of the above relations follow below.

Example 1: Find the amount S to which $1000 would build to in 10 years if placed in a savings account at 2% compound semi-annually.

Solution: The recent interest rate is always given as the nominal rate. Hence, i = 0.02/2 = 0.01, and n = (2) (10) = 20 periods. Then
S = CAF_s ($1000) = 1.220 ($1000) = $1220 (answer).

Here $CAF_s = (1.01)^{20} = 1.220$ from tables or by logarithms.

Example 2: What sum would have to be deposited today in a savings account to provide a perpetual annual income of $1000 (paid at the end of each year)? Interest is to be taken as 4%.

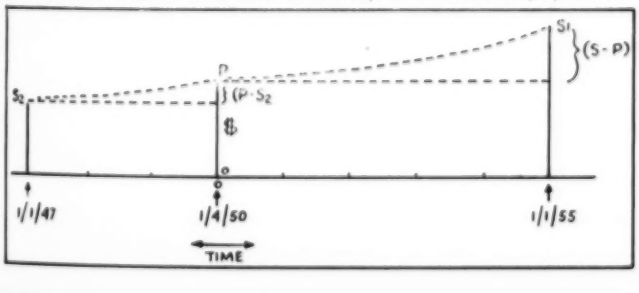
Solution: This is a case such as in *Fig. 4* where simple interest is removed from the accumulated amount at the end of each year. (here h = 1)

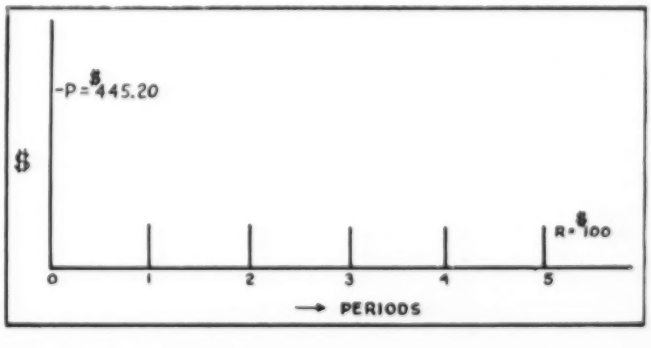
P_o i = P_o (0.04 = $1000

P_o = $1000/0.04 = $25,000 (answer).

Example 3: What sum would have to be deposited in a savings account today to realize $10,000 in 15 years, if the interest received is 2% com-

Fig. 1 (below). The equivalence of money.
Fig. 2. Equivalence of a sum of money to a series of payments.





pound annually?

Solution:

$$P_o = \$10{,}000\left[\frac{1}{(1.02)^{15}}\right] = (\$10{,}000)(0.7430) = \$7430 \text{ (answer)}.$$

Here the $PFW_s = \left[\frac{1}{(1.02)^{15}}\right] = 0.7430.$

Example 4: What single interest for one year would be equivalent to 8% compound every three months?

Solution:

$P_0 (1 + i_0) = P_0 (1 + 0.08/4)^4$

If P_o does not equal zero, then

$(1 + i_o) = (1 + 0.02)^4$

$i_o = (1 + 0.02)^4 - 1 =$

$1.082 - 1 = 0.082$

or $i_o = 8.2\%$ (answer).

Example 5: For the case of Example 4 above, what would be the nominal interest rate equivalent to *continuous* compounding?

Solution: At first glance the engineer might think that continuous compounding, where the number of periods per year tends to infinity, would result in very high or infinite interest rates. Such is not at all the case. In fact, continuous compounding is very little greater than monthly compounding.

$$i_o = \left[\lim_{h \to \varphi} (1 + j/h)^{mh}\right] - 1$$

$$= \left[\lim_{h \to \varphi} \left(1 + \frac{1}{h/j}\right)^{h/j}\right]^{mj} - 1$$

$$= (\varepsilon^{mj} - 1) = (\varepsilon^{0.08} - 1) = (1.083 - 1) = 0.083$$

where

ε is the base of Naperian logarithms.

or $i_o = 8.3\%$ (answer).

In all of the above examples, the values of CAF_s and PWF_s are obtainable for various i's and n's from standard interest tables, or the factors may be computed by resorting to logarithms, using the formulas given in this article. Note here that PWF_s factors are merely reciprocals of the CAF_s factors.

2. *Uniform series transactions*

Uniform series transactions refer to obtaining equivalent sums, either at t = 0 or at t = n, for a series of n payments of R dollars each made at the end of each period. For convenience in this article it is assumed that all transactions will be made on the basis of end-of-the-period payments. If beginning-of-the-period payments are to be used, the symbol for the uniform payment is changed to T, and a different set of formulas must be derived.

If the equivalent amount S is calculated at t = n, for the series of payments of R dollars each, then the uniform series transaction is termed a *sinking fund type.* If an equivalent amount P is calculated at t = 0, for the same series of payments of R dollars, then the transaction is termed an *annuity,* or *capital recovery type.*

In order to compute the sum S which is equivalent to a series of equal payments of R dollars, refer to *Fig. 6.* The last, or n-th, payment bears no interest and contributes R dollars to the sum S. The (n - 1)-th payment contributes R (1 + i), the (n - 2)-th payment contributes R $(1 + i)^2$, and finally,

$$S = R\left[1 + (1 + i) + (1 + i)^2 + + + (1 + i)^{n-1}\right] \quad \text{Eq. 7}$$

If equation 7 is multiplied by (1 + i), the result is

$$S(1 + i) = R\left[(1 + i) + (1 + i)^2 + (1 + i)^3 + + + (1 + i)^n\right] \quad \text{Eq. 8}$$

If Equation 7 is subtracted from Equation 8, the following expression results,

$S\,i = R\left[(1 + i)^n - 1\right]$, or

$$S = R\left[\frac{(1 + i)^n - 1}{i}\right] \quad \text{Eq. 9}$$

The term in brackets of Equation 9 is called the *compound amount factor* of the *uniform series,* or

$$CAF_u = \left[\frac{i}{(1 + i)^n - 1}\right] \quad \text{Eq. 10}$$

If Equation 9 is solved for R instead of S, the reciprocal of CAF_u is obtained. This latter factor is called the *sinking fund factor,* and

$$SFF_u = \left[\frac{i}{(1 + i)^n - 1}\right] \quad \text{Eq. 11}$$

Tables of these factors are available in several of the references listed at the end of this article, and in many books and sets of interest tables. The factors are given for various n's and i's.

In *Fig. 6,* note that the graph appears similar to a flight of stairs, the treads of which have constantly increasing slope as time increases. This increase in slope is accounted for by the fact that "interest-on-interest" is being paid as the amounts accumulate.

In the annuity type of transaction, as illustrated in *Fig. 7,* the amount P is found by a process similar to that given previously. P must equal the sum of all of the payments of R dollars multiplied by their respective PWF_s's. Thus,

$$P = R\left[1/(1 + i) + 1/(1 + i)^2 + + + 1/(1 + i)^n\right] \quad \text{Eq. 12}$$

Multiplying by (1 + i) as before,

$$P(1 + i) = R\left[1 + 1/(1 + i) + + + 1/(1 + i)^{n-1}\right] \quad \text{Eq. 13}$$

Subtracting Equation 12 from Equation 13, an expression for P is obtained,

$$P\,i = R\left[1 - 1/(1 + i)^n\right] = R\left[\frac{(1 + i)^n - 1}{(1 + i)^n}\right]$$

or

$$P = R\left[\frac{(1 + i)^n - 1}{i(1 + i)^n}\right] \quad \text{Eq. 14}$$

The term in the brackets of Equation 14 is called the *present worth factor* of the uniform series, or

$$PWF_u = \left[\frac{(1 + i)^n - 1}{i(1 + i)^n}\right] \quad \text{Eq. 15}$$

The reciprocal of the factor in Equation 15 is called the *capital recovery factor* of the uniform series, and is written,

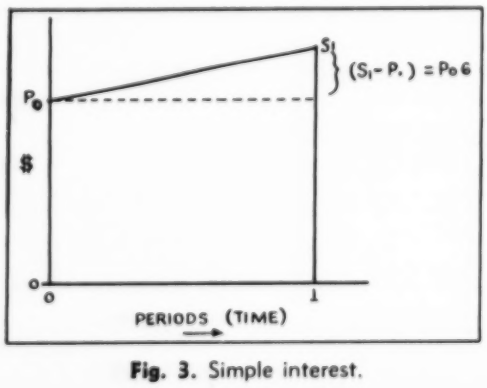


Fig. 3. Simple interest.

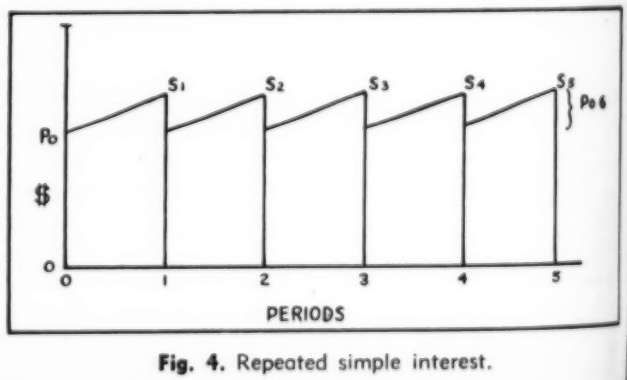


Fig. 4. Repeated simple interest.

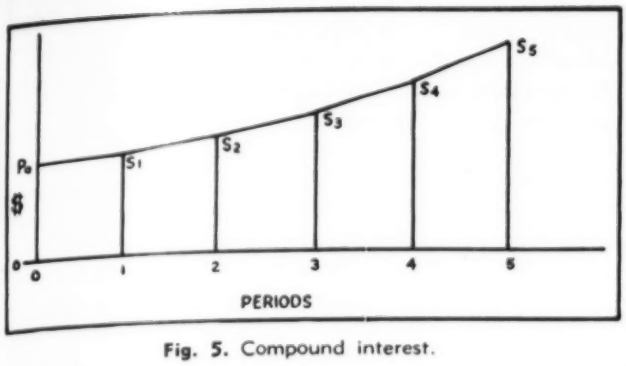


Fig. 5. Compound interest.

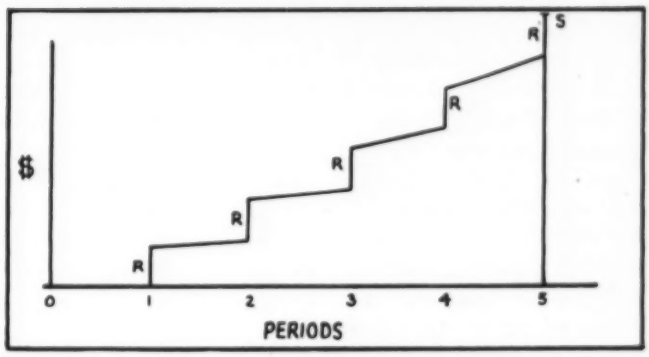


Fig. 6. Sinking fund transaction.

$$CRF_u = \left[\frac{i\,(1+i)^n}{(1+i)^n - 1}\right] \qquad \text{Eq. 16}$$

These two factors, the PWF_u and the CRF_u, provide means of computing for P and R in situations as outlined by *Fig. 7*. This graph appears like descending stairs, where the treads are of decreasing slope. As before, the change in slope is produced by the presence of interest.

Equations 4 and 6, 10 and 11, and 15 and 16 now define three pairs of factors which form the basis for most computations in engineering economic analysis. The first pair has been illustrated by examples previously; examples will now be given for the other two pairs.

Example 6: $100 is put into a savings account at the end of each six-month period. If interest is at 4% compound semi-annually, what is in the account at the end of 20 years?

Solution:

Here $i = j/h = 0.04/2 = 0.02$
$n = (2)(20) = 40$
$R = \$100$
Hence, $S = (R)\ (CAF_u) = (\$100)$
$(60.402) = \$6{,}040.20$ (answer).

Example 7: For a certain machine in a factory a maintenance charge of $100 is assumed to occur at the end of each year for 10 years. What is the largest sum that could be spent now to prevent these maintenance bills?

Solution: $j = i = 0.04$
$n = m = 10$
$R = \$100$
Hence, $P = R\ (PWF_u) = (\$100)$
$(8.111) = \$811.10$ (answer).

Note here that the direct sum of all the maintenance charges is $1000; however, this sum has little usefulness, and no meaning from an economic analysis standpoint.

Example 8: A man obtains a mortgage on his home for $10,000. He arranges to pay back interest and principal together in the form of equal quarterly payments over 10 years. If the nominal interest rate is 6%, what is the uniform quarterly payment?

Solution:

$i = 0.06/4 = 0.015$
$n = (4)\ (10) = 40$
$R = (P)\ (CRF_u) = (\$10{,}000)$
$(0.03343) = \$334.30$ (answer).

Example 9: It is desired to build up a fund of $10,000 in 10 years in order to replace a pipeline ditcher. How much should be set aside at the end of each year, if the nominal interest rate is 5%?

Solution:

$i = 0.05$ (assume annual compounding)
$n = 10$
$R = (S)\ (SFF_u) = (\$10{,}000)$
$(0.07950) = \$795.00$ (answer).

In concluding this brief discussion of money and interest rates, it should be noted that most problems can be handled by one or more successive applications of the three pairs of factors as outlined in previous paragraphs. To summarize, these three factors are:

(1) Single-payment transactions:
(CAF_s) and (PWF_s)
(2) Uniform series transactions:
(CAF_u) and (SFF_u)
(CRF_u) and (PWF_u)

The second factor of each pair is, again, the reciprocal of the first factor. In all of the computation methods outlined so far, the element of inflation or deflation has not entered. This factor must be determined separately, and has nothing to do with the mathematics of finance presented to this point.

Methods of economic analysis

There are three principal methods of analyzing an economic situation for costs. These may be listed as:

(1) Equivalent annual cost.
(2) Present worth (or capitalized cost).
(3) Rate of return on incremental investment.

The first of these is probably the most useful to the corrosion engineer, although the second has merit in certain situations. The third is useful when some increment of investment is examined to determine whether it is justified in terms of the revenue produced thereby.

1. Equivalent annual cost

This method involves determining all costs of a situation on an annual basis. In most cases the main divisions of cost may be listed as:

(a) Interest on investment.
(b) Depreciation.
(c) Taxes and insurance.
(d) Operating costs.
(e) Maintenance costs.
(f) Overhead.

It seems desirable to discuss each of these items in turn.

Interest on investment (a) is a charge that many persons are prone to neglect. The argument is sometimes advanced: You use your own funds to purchase this equipment; therefore, no interest need be considered. Such an argument is indeed fallacious. If you use your own money to purchase the equipment, you are, in fact, minus the interest this money would earn for you, so long as this money is tied up in the equipment, or plant assets. The plant or equipment must earn this interest return, in addition to meeting remaining costs. The computation for the proper rate of interest to use in a particular organization or situation may be somewhat difficult to arrive at. Such factors must be considered as:

What is the average market interest rate available to the organization?

What rate of bond interest is being paid? What dividends are being paid on common and preferred stocks? and so forth! Even if money is available through bond issues at 3½%, this interest rate does not include financial risk adjustments, underwriting costs, and the fact that the company can only borrow a part of its funds through low-interest bearing bonds. Probably a proper rate to use for engineering economic calculations at the time of writing (1954) would be in the range of 5% to 7%, depending upon the security of the organization and many other factors.

Depreciation (b) refers to the fact that physical plant and equipment (not including real estate) usually has a finite and predictable life. If the equipment is to remain available, then, on an indefinite basis, money must be accumulated, or be available, to repurchase or renew the equipment at the end of its life. There are three common methods of determining how much of this depreciation charge should be allocated to a particular year.

The first is the *straight-line method*, commonly used by accountants and for government income tax purposes. It has the advantage of ease in computation, but the disadvantage of being unrealistic in that interest rates are ignored, or considered zero. If L is the net salvage value of the equipment at the end of n periods (m years), and P is the original installed cost, the annual depreciation charge is computed as:

$$D = \frac{(P - L)}{m} \qquad \text{Eq. 17}$$

The *book value* is represented by the ordinate b_1 in *Fig. 8*, and shows the supposed current value of the equipment. This may or may not coincide with the true market value.

The second is the *sinking-fund method*. In this method it is assumed that the annual depreciation charge is given by computing a uniform annual amount which would build up to a sum (P —L) at the end of m years. From an engineering economy standpoint this method is probably the most realistic since it takes interest rates into consideration. However, to business executives it may be less desirable since the annual charge is less than $\frac{(P - L)}{m}$, and the book value changes slowly at first and more rapidly toward the latter portion of the life. The executives would rather set aside a larger amount at first, perhaps, to be on the safe side in marginal enterprises, and to obtain larger tax deductions when the business risks are larger. The method is also in disfavor with accountants because of the more complicated calculations involved. The annual depreciation charge is calculated by:

$$D = (SFF_u)\ (P - L) \qquad \text{Eq. 18}$$

The book values must be computed separately for each time, say t_2, by subtracting from P and the amount which would have accumulated in the hypothetical sinking fund. The ordinate b_2 in *Fig. 8* is such a book value.

The third method is the *Matheson method*, which is characterized by using as the annual depreciation charge a fixed percentage of the previous year's book value. Thus the book value at the r-th year is given by the relation,

$$\text{Book value} = P\ (1 - f)^r \qquad \text{Eq. 19}$$

where f is a fixed fraction of unity. At the m-th year, the book value becomes the salvage value L, or,

$$L = P\ (1 - f)^m \qquad \text{Eq. 20}$$

Hence,

$$f = 1 - \sqrt[m]{L/P} \qquad \text{Eq. 21}$$

This method has the disadvantage that it cannot be used with zero or negative salvage values, and is more difficult to compute than the straight-line method. It has the advantage of larger annual depreciation allocations in the first years of the life, a situation favored by business executives. It also produces book values which are closer to market values for many types of equipment—for example, trucks and automobiles. The ordinate b_3 in *Fig. 8* shows a book value for this method, at time t_3.

It is possible also to use several straight lines of successively different slopes over the life of the equipment, and other composite methods.

The depreciation charge can be, if desired, combined with the item (a), interest on investment, by the use of the following relations:

$$D + (\text{Int. on Inv.}) = (P - L)\ (CRF_u) + Li \qquad \text{Eq. 22}$$

and an alternative relation:

$$D + (\text{Int. on Inv.}) = \frac{(P - L)}{m}\ [1 + (i/2)\ (m + 1)\ ] + Li \qquad \text{Eq. 23}$$

Equation 23 presents a relation which is an approximation of Equation 22, and which is not particularly accurate if m is over 20 and i is more than 0.08. It does have the advantage that tables are not necessary for computation.

Any of the depreciation methods used involve determination of an *estimated life* for the equipment in question, and also a *salvage value*. Estimations of life may be made by reference to past experience, or, if experience is available covering large numbers of units, survivor curves may be constructed using statistical and actuarial methods. Turnover curves showing additions and retirements of plant equipment may also be used if the history includes large numbers of units. Reference (1) at the end of this article describes and gives examples of both of these methods of estimating life. Salvage values must be determined by estimating future market values and subtracting the cost of salvage. It is not

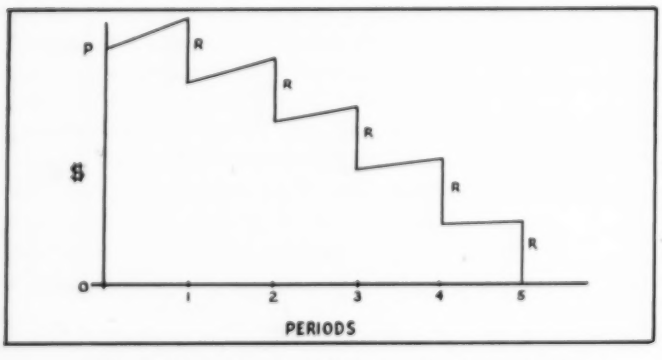


Fig. 7. Annuity, or capital recover, transaction.

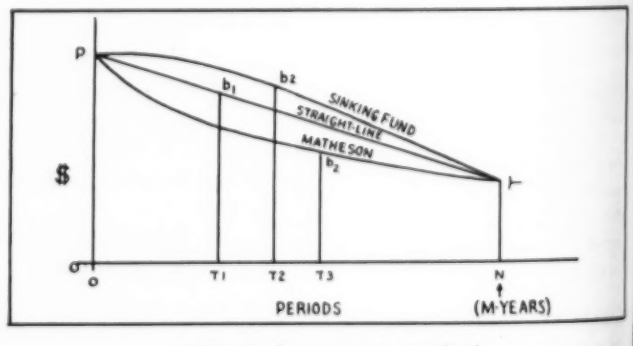


Fig. 8. Depreciation method.

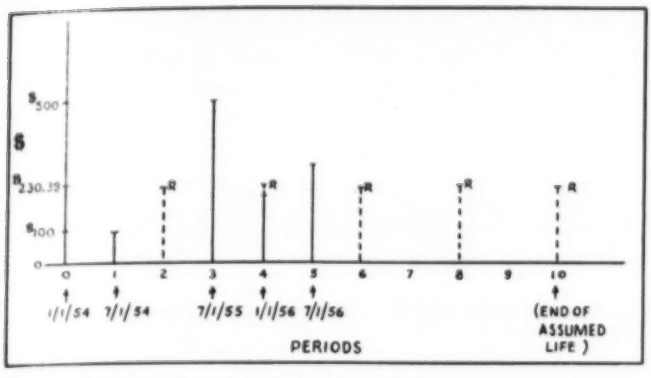


Fig. 9. Computation of equivalent annual maintenance charges.

uncommon to find that the salvage value is negative. This might account for the fact that many cities have left street-car rails imbedded in the pavements of the streets.

Taxes and insurance (c) will vary depending on the business carried on, the insurance risks, and so forth. The usual annual figure used in many economic studies will be around 3 to 4% of the original investment.

Operating costs (d) may be divided into those that occur naturally on an annual basis, and those that occur per unit of operation. The second variety will have to be converted to an annual basis by an estimation of the number of unit operations per year. Operating costs may include power and fuel costs, operation labor, direct supervision, and similar items.

Maintenance costs (e) may be more difficult to allocate in terms of annual costs. Some portion of maintenance, which is routine and regular, will occur in about the same amounts each year. This portion can be estimated on an annual basis without difficulty. Other maintenance costs, such as major overhauls of equipment and major repairs, may occur once in several years. For this portion of the charges an estimate should be made of the amounts and times of such anticipated expenditures over the life of the equipment. Then all amounts should be brought back to $t = 0$ as a sum of present worths, and the CRF_u applied to find an R. The R thus obtained is then taken as an annual maintenance cost. The following example illustrates this type of maintenance calculation:

Example 10: A certain piece of construction equipment is purchased on Jan. 1, 1954, and assumed to have a five-year life. Major maintenance costs are estimated as follows: July 1, 1954—$100; July 1, 1955—$500; Jan. 1, 1956—$200; and July 1, 1956—$300. If interest is assumed at 4% compound semi-annually, what is the uniform annual maintenance charge?

Solution: Fig. 9 shows these charges as ordinates of a graph. Each charge must be reduced to its present worth as a first step.

$$P = (S)\ (PWF_s)$$
$$P_1 = (\$100)\ (0.9804) = \$\ 98.04$$
$$P_3 = (\$500)\ (0.9423) = \$471.15$$
$$P_4 = (\$200)\ (0.9238) = \$184.76$$
$$P_5 = (\$300)\ (0.9057) = \$271.71$$

Total P $1025.66

Interest has been assumed as 4% compound semi-annually; however, the maintenance charges must be computed on an annual basis. For this reason, an i_a should be computed from the given rate, and used as a new i.

$$i_a = (1 + 0.02)^2 - 1 = 1.040 - 1 = 0.04$$

In this case the difference between the effective and nominal rates is extremely small, and is undetectable by the tables used. Now, using $i = i_a = 0.04$, and $n = m = 5$,

$$R = (P)\ (CRF_u) = (\$1025.66)\ (0.22463) = \$230.39\ \text{(answer)}.$$

In *Fig.* 9, this value of R is shown as the required uniform annual series, and the maintenance charges may now be added in to the other annual costs.

Overhead (f) should be considered in the economic study only if two or more alternatives involved differ materially in overhead allocations. Of course, if total costs are wanted, overhead must be included. The amounts or percentages to use for overhead may be obtained by consulting the organization's accounting department or executive departments, and will vary widely from one organization to another.

2. *Present worth method*

In this method all costs are evaluated as portions of a total present worth. To the original investment cost is added the present worths of the various series for annual operating costs, the present worths of all maintenance costs, the present worths of all future replacements (or the present worth of the annual depreciation charge series), etc. Present worths of salvage values are then subtracted, and a total present worth is computed. This method is usually more difficult for most engineers to use than the annual cost method, and therefore is given little space in this article. It sometimes has advantages, however, in determining what present investment is justified to prevent some estimated uniform annual series of expenditures.

The annual cost method can be converted to present worth method by the simple means of dividing all annual amounts by the assumed nominal interest rate, if desired.

3. *Rate of return on increment investment*

This is a special and less used method involving the determining of an interest rate which would make two amounts occurring at different times equivalent to each other; usually one is a payment, and the other a receipt of money. Assume that there is a prospect for higher revenues provided a certain higher investment is chosen over some lower cost alternative. The interest rate which would make the *increase* in revenue equivalent to the *increase* in investment is called the rate of return on incremental investment.

So far the element of inflation and deflation has not been considered. In preliminary studies of an engineering nature it is usual to ignore this rather important aspect of the economic picture, and treat it as a matter of executive judgment. This matter will be mentioned again at a later time when the methods of analysis are applied to corrosion and cathodic protection problems.

In conclusion, the important tools of analysis—mathematics of finance and methods of annual cost and present worth computations—have been presented in an elementary manner. The next step will be to apply the analysis tools to problems peculiar to the corrosion and cathodic protection field, which will be done in the next issue of *GAS*.

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Intra-company truck standardization streamlines operations at saving in cost

How three major companies have stepped up efficiency through careful design and specification work and elimination of customizing of individual units.

By **FRANK CHAPMAN** • Editor

GAS exclusive

THE standardization of fleet truck bodies has served as an aid to gas distribution companies throughout the country in keeping pace with the ever-increasing customer volume that has been experienced during the past few years. At the same time the practice has served to provide a greater degree of efficiency in the operations departments and to afford a measure of economy in the face of rising costs. The greater safety of personnel involved is still another attribute of a sound program of truck body standardization.

Value realized

Standardization is no new thing to gas industry engineers and supervisors. The value to be realized from such a practice has been more evident to them as a result of its application throughout many other phases of industry. Standardization in truck body design is no different in its overall purpose than the other programs of standardization with which industry men are concerned. The basic purposes are the same regardless of the operations to which they are applied.

In the case of truck bodies, the basic design practice is to standardize upon a design that will make the work crews more self sustaining without becoming burdened with superfluous equipment and tools. Compactness and neatness in design have permitted the inclusion of more equipment and tools while at the same time making them more readily available to workmen. The one best design for the maximum safety, comfort, and efficiency of the workmen is the design upon which standardization is built.

Varying design

Although specific design considerations with respect to body details may vary from utility to utility because of certain peculiar requirements of the company, there is a similarity throughout the industry in the basic requirements for a particular type of service. This is understandable because of the similarity in tools and materials used by all gas utilities in any given type of service. Methods of compressor mounting and the arrangement of tool and material storage compartments are problems which confront all gas utility engineers and supervisors alike. Because of this, an exchange of ideas between companies as an integral part of a standardization program can be of advantage to the industry as a whole. Such an exchange of ideas is like that commonly employed to arrive at standard recommended practices that have been so valuable to gas industry operating departments.

The program of fleet truck body standardization that has been carried out by three representative distribution companies will serve to indicate the approach that has been taken and the trend toward standardization that has developed in the industry. It will also serve to indicate similarities in the design of bodies for any one particular type of service by more than one company, and the differences that exist because of the peculiar requirements of each. Although the three companies chosen are all large distribution companies, they differ considerably in the expanse and configuration of the area served.

The Laclede Gas Co. of St. Louis, for instance, has turned to a program of

AGA members to study automotive equipment

The subject of motor vehicles will share one-third of the delegate's attention at the AGA distribution meeting in Montreal this month. Inspection trips to see equipment will be a prime feature of the program.

company-wide standardization to increase productivity and combat rising costs. The company feels that these are major problems confronting the gas industry today, and that constant effort must be exerted to hold the line on equipment and operation costs while still showing a marked increase in gained revenue service.

Although many hours of thought, trial and supervision are required, standardization has become the watchword with both executive and operating departments. The personal interest shown by Laclede personnel in the matter of standardization has been rewarded with an increase in efficiency of both equipment and labor. Equipment replacement programs are found to be easier to analyze and to control, and customer approval has resulted because of prompt and effective service installation, and because of better emergency and repair service.

Noteworthy development

Through the joint efforts of the transportation and distribution departments of Laclede Gas, a noteworthy emergency leak repair unit has been developed. This vehicle is the newest addition to the Laclede fleet of 565 active motorized vehicles and contains such basic requirements as maximum utility, flexibility, reasonable operating cost, crew approval, and neatness and simplicity of design.

The nine emergency leak repair units, now being used in St. Louis and St. Louis county, are just what the name implies. The vehicle consists of a suitable truck chassis on which is mounted a custom utility body designed to ac-

Left side view (top) of Laclede's emergency leak repair truck with compartment doors in an open position, showing storage of lanterns, shovels, and solvents, along with the amount of space available in the compressor compartment to provide the compressor with proper breathing.

Right side view (above) illustrates storage of pneumatic paving breakers, spades, hammers, and backfill tampers. The manner in which the compressor is installed on slides provides ease of repair along with ease of operation.

Left side view (left) shows closed compartments, and indicates accessibility to the interior compartments and hose reels from the rear of the body unit.

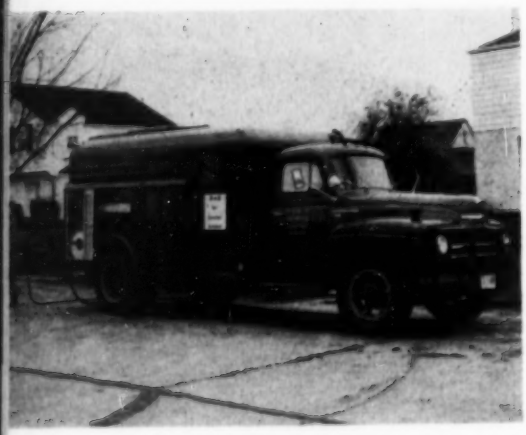
commodate a self-contained rotary, 105-cfm two-stage, oil-cooled compressor that is easily removable and provides minimum weight, size, and maintenance cost.

Time-saving features

Through the use of mobile phones, installed in the vehicle, loss of time between jobs is cut to a minimum; with maximum utility built into the body unit, backtracking to the storeroom for tools or materials has been essentially eliminated.

The utility body was built by the McCabe-Powers Auto Body Co., St. Louis, and has provisions to accommodate, in addition to the compressor equipment, pneumatic paving breakers, spades, hammers, and backfill tampers. These items are loaded and carried in the most accessible location.

When an emergency leak repair unit is assigned to a job, it is expected that



Public Service Co.'s 2½-ton gas operating truck features a mounted air compressor. Here, compressor breaks pavement preparatory to running a new service for a new home.

the particular unit can complete the repair unassisted and in the minimum time required. Therefore, leak detecting equipment, along with gas masks and air line respirator that work from the compressor, are standard equipment that are housed in the body unit.

Two long pipe troughs, for handling long sections of pipe, have been built into the superstructure and partitions are located in other compartments to accommodate the maximum in pipe fittings, small tools and other miscellaneous items.

As in the case of all emergency equipment, space has been provided in the body for fire fighting equipment, rubbergoods, digging bars and shovels.

The emergency leak repair unit, which is a direct outgrowth of Laclede's program of standardization in equipment and methods, has resulted in widely reduced costs in preventive and corrective maintenance in both the transportation and distribution departments.

In contrast to the essentially compact area serviced by Laclede Gas Co. is the 17-county service area of the Northern Illinois Gas Co. (formerly Public Service Co.'s gas division). Although the service area is more widespread the problems are much the same. Prompt and efficient service to thousands of rural, residential, and industrial customers scattered throughout the area can only be handled through the sound design of work trucks used for the purpose. In fact, the continuing demand for new and additional service has required that the company make use of the most modern methods and equipment in the field.

Truck for new services

The problem of a standardized truck body for use in installing new gas service and mains is one which has been worked out by Northern Illinois. Early design provided for a truck-mounted air compressor that could be used with the air-powered equipment for breaking holes in basement walls for service connections, for pavement breakers and air-powered tampers. The compressor was also used for powering a winch which was used for backfilling trenches with hand scrapers. In cooperation with McCabe-Powers, a 1½-ton truck body was developed in 1934 that incorporated these features.

This design was found to be adaptable in both rural and congested areas and, following World War II, it was redesigned by Northern Illinois Gas Co. and McCabe-Powers on a new 2½-ton truck. This vehicle included a crew cab that was not a part of the original design. It is this vehicle that is currently in regular use by Northern Illinois Gas Co.

Flexible compressor

A 105-cfm compressor, driven by power take-off from the truck engine, is mounted directly behind the crew cab. In application this compressor has been found to provide ample power for the operation of all types of air-powered pavement breakers and tampers. It is also used to power an air winch located on the rear of the truck.

Enclosed compartments are provided for storing all air powered tools and rolls of air hose. Pipe troughs are also built into the body for the purpose of handling long lengths of pipe. Additional compartments are provided for small tools and miscellaneous materials.

Lone Star Gas Co.'s Dallas division is a third example of how standardization in fleet truck body design has led

Air winch on a roller, which allows winch line to swing 180°, is used by Public Service Co. to backfill new service trench. Winch is powered by compressor driven to a power takeoff from the truck engine.

to a more streamlined operation. Lone Star, now serving in excess of 170,000 residential, commercial, and industrial gas customers in the Dallas division, has shown an increase of more than 46,000 customers in the past five years in this area alone. In an effort to keep up with this ever increasing need for new services and mains it was essential that the most efficient equipment and methods be put to use.

Conference beginning

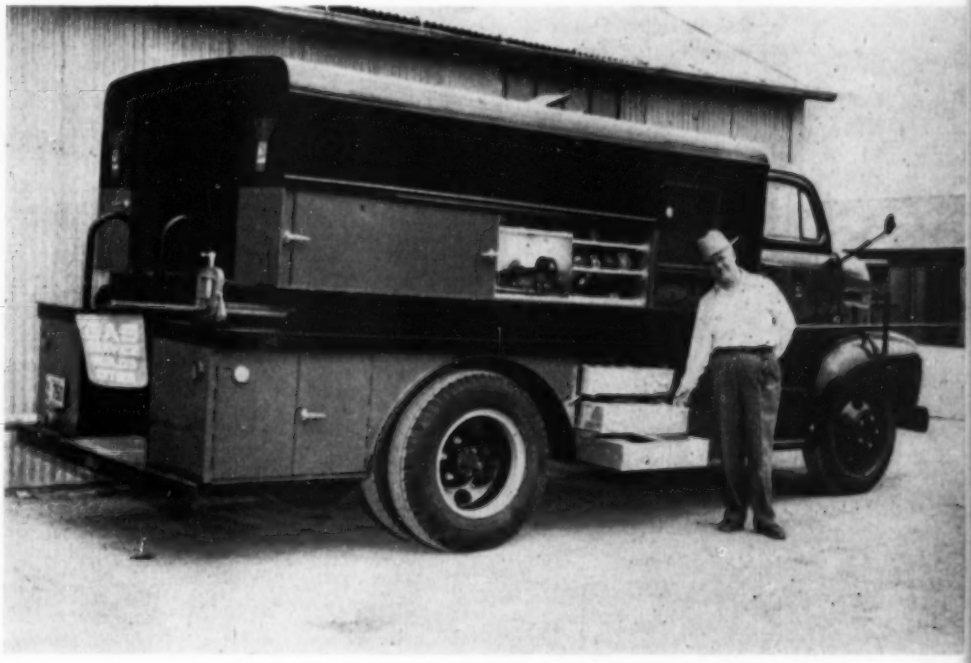
Standardization of fleet equipment in the company's Dallas division, begun several years ago, has been an aid to keeping pace with this customer growth, and at the same time, has resulted in greater efficiency and economy, increased safety, and a boosting of morale among the employees affected.

Prior to the standardization program, Lone Star purchased the best equipment available, but it did not always fit the company's individual needs.

Beginning at the conference table, Dallas division engineers and supervisors worked out the problems involved in distribution operations dependent upon fleet equipment. From there, the ideas moved to the drafting board, where careful study of mechanical details and requirements was incorporated into new fleet designs, with every truck feature being designed for a specific purpose. Then the company handed the designs to manufacturers, who turned out the custom-built equipment. Truck bodies have been built for Lone Star by McCabe-Powers Auto Body Co.; Texas Sheet Metal, Dallas; J. H. Holan, Cleveland; and Southern Ornamental Iron Works, Arlington, Texas.

The street department service truck is virtually a shop on wheels. It can handle an average day's work without deliveries of auxiliary equipment from the warehouse or checkbacks, thus saving valuable time. Six of these 17 trucks for maintenance and light construction have been made even more complete in the past three months. They have been fitted with arc welding units, which the foreman of the crew can handle, making it unnecessary for separate welding units to come out on the job. All of the heavy maintenance trucks are equipped with an air compressor for operating air tools used in laying new services, short main extensions and maintenance.

Outside enclosed tool boxes are built on both sides of the truck. On one side are the tools for new construction; on the other side are kept the tools for maintenance. Subdivisions in each drawer of the tool boxes afford a complete breakdown of fittings according to type and size. One drawer is reserved for recovered fittings, which are turned in to the warehouse each night for rehabilitation of those which are usable. The fittings used are replaced each night so each truck has a standard supply of fittings at all times. With such an orderly arrangement of tools and equipment, a big warehousing problem has been solved. It is now possible to inventory trucks almost at a glance.



Easily accessible tool boxes, built on each side of the heavy maintenance trucks in Lone Star's Dallas division, hold conveniently placed tools—those for new construction on one side and those for maintenance on the other side of the truck.

Sliding doors

Compartments for larger equipment are enclosed by sliding doors, while smaller equipment is contained in sectionalized drawers constructed of 14 gauge steel, painted aluminum. Ball bearing rollers make opening and closing of drawers easy.

Bulkier items, such as street barricades, probing bars, long tools, brooms, raincoats and boots, are kept in inside compartments, as are sharpshooters, shovels, picks and paving breakers which are stored under the "tool box" seats.

Crews, who formerly rode in open trucks unprotected from the elements, now ride in a truck almost completely enclosed, with ventilators in the top for summer comfort. A non-skid safety step across the back of the truck and grab rails make it easier to enter and leave the truck. Drinking water is carried on the truck in a specially designed container, which, incidentally, turned out to be one of the biggest headaches to the designers, who had to have a container that would not leak and would not corrode and that would keep the water cold.

Along with the street department service truck, the shop service truck, used for service calls, also has been modernized. It is a pickup type with specially designed tool box and meter racks. The need for an economical approach to a more efficient tool box resulted in the present design which also has enhanced the appearance of these trucks. The box is removable, but it gives the appearance of being a permament part of the truck itself. It is painted red, as are the truck bodies.

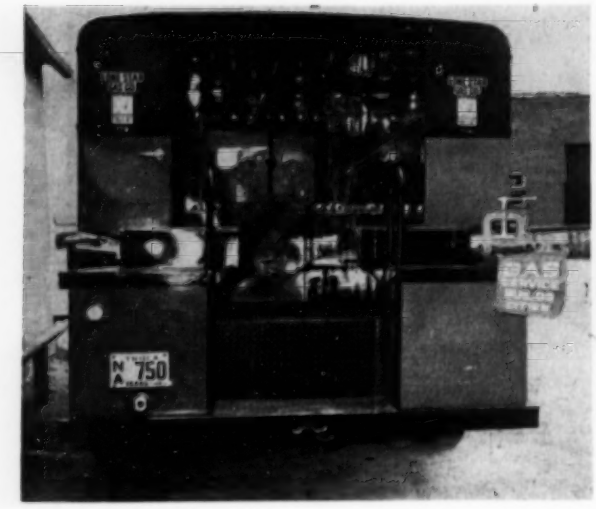
Accessible tool box

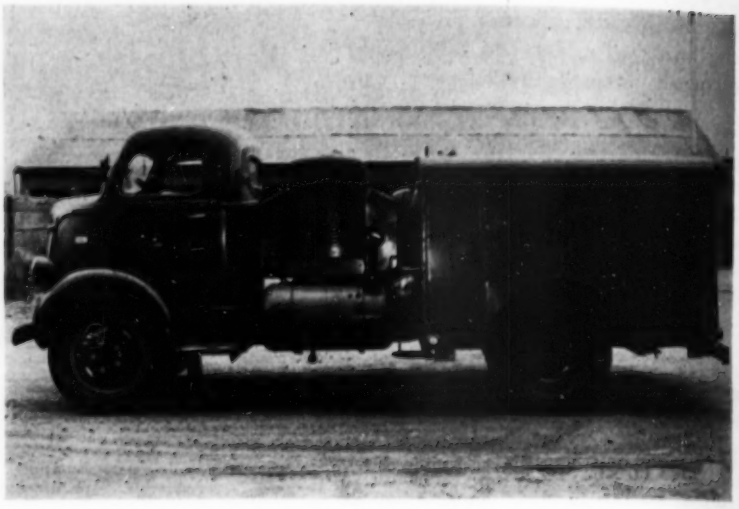
Each tool box lid breaks into two sections, accessible from either side of the truck and inside drawers are only half the width of the box so that they may be pulled to either side, revealing tools and fittings in drawers below. Sixty-four compartments are provided in

Right: Grab rails and non-skid step at rear of Lone Star truck are important safety features that have been incorporated in the custom-built street department service trucks of the Dallas division.

Below, left: Lone Star's Dallas division fleet includes two Hydrauger trucks for boring under pavement. The modernized truck is a complete unit with a Jaeger 105 GF air compressor.

Below, right: Servel air conditioning trucks are specially equipped for installation and maintenance of air conditioners in the Dallas division.





each tool box, and inside each lid is a print showing the standard arrangement to be followed in loading tool boxes on all trucks of this type.

The breakdown described on the print in each box results in familiarizing each serviceman with the arrangement, thus speeding the handling and use of materials. It also simplifies inventory after each day's work. Material used during the day is accounted for on storeroom requisitions and turned in each night so that materials can be replenished before the next day's run.

Meter racks

Back of the tool box can be carried specially designed removable meter racks, which also provide greater efficiency and improve appearance in transporting new and changed-out meters.

The fleet's two Hydrauger trucks, used to bore under pavement for new mainline and service line street crossings, were naturally bulky and difficult to streamline, but they have been made attractive members of the fleet. With the Hydrauger, breaking of pavement is avoided, the hole being drilled beneath the pavement and flushed out with water which is used under pressure.

Complete unit

In the new truck the 500-gal. water tank and most of the bulky equipment are housed in a neat rear compartment. Now it is not necessary to haul an auxiliary compressor out to the job, for the modernized Hydrauger truck is a complete unit with a Jaeger 105 GF air compressor installed on the chassis with instrument panel, starter and clutch for the unit located on the curb side. The operator thus can have complete control of compressor, winch, water and air connections from this side of the truck. A special compartment directly behind and under the compressor was built to carry approximately 50 drill stems.

Another piece of equipment designed to conform with the company's modernized fleet in its Dallas division is the specially equipped Servel air conditioning service truck, used for air conditioner installation and maintenace. Each of these five panel-type trucks is equipped for handling major and minor service calls on a single trip to the customer's home. It has inside compartments and drawers custom-built to the needs of this particular service.

The standard fleet colors of red and black have been utilized on all trucks.

Standardization continues

Standardization of fleet equipment is also being developed in the greater Fort Worth district, with about 104,000 gas customers 30 miles to the west, also served by Lone Star. Like Dallas, Fort Worth has experienced mushrooming growth since World War II and is finding it helpful to carry out a program of fleet standardization.

In addition to these two cities, Lone Star serves some 400 other smaller cities and towns in Texas and Oklahoma.

GAS staff report

MATERIALS HANDLING

IN THE GAS INDUSTRY

By **FRANK CHAPMAN** • Editor

THE growth of the natural gas industry during the past few decades has been so rapid and so extensive that often time and facilities have not permitted proper consideration of certain generally accepted industrial techniques. The study and application of good practice in materials handling and storing is an example of an activity that has been so ignored by the industry.

Only recently has a serious and concerted effort been given to a consideration of the methods and philosophies of materials control in the gas industry. In those instances where such an effort has been made the value of good practice has become immediately evident and substantial economies and improvements in service have resulted from relatively minor alterations in storing and handling methods.

The results have, in fact, proved that there can be no argument but that proper consideration of the methods of storing and handling has a part in the efficient, safe, and economical functioning of every department of every gas company—a statement that can be made of no other single activity in the industry.

The extent of the activity is of particular interest. The methods that are to be used in the storing and handling of materials must be the concern of the pipeline compressor station manager just as they must be the concern of the manager of the meter repair department. The materials handling problems faced by the division manager of a large distribution system are much the same as those that confront the construction superintendent. Even the accounting and appliance sales departments have their own particular storing and handling problems.

Although the transportation and storeroom people are, by the nature of their activity, more directly concerned with handling and storing than any other personnel within the industry, if the problem is to be approached on a functional basis it will be seen that the techniques and methods used by trans-

Materials handling from a distribution standpoint

One of the most expensive functions performed in connection with distribution is materials handling. Although it isn't strictly a distribution function, it is closely allied with it.

What recognition is the gas industry giving to the new-found importance of scientific materials handling operations?

Leadership in the field had been undertaken by the purchasing and stores committee of the AGA. This committee, made up of men close to the gas industry and intimately acquainted with its problems, has taken broad steps to apply the best industrial techniques to its own operation. The results of their efforts have borne fruit in some instances and are leading toward noteworthy improvements in the future.

This committee is a fairly new group which was, until the spring of 1952, a part of the accounting section of the AGA. At that time it was known as the materials and supplies section of the accounting group. The first meeting of the independent group was held in the spring of 1952 in Memphis and was attended by some 40 persons. Attendance doubled in the spring of 1953 when the committee held its next annual meeting in Milwaukee. This year's meeting of the group in April at Atlanta, Ga., is expected to draw more than 100 persons.

Activities of the group have been sparked by Pat H. Butler of the Washington Gas Light Co., who is 1953-54 chairman. His efforts to bring together a set of facts that will lead to better techniques for storeroom design have been well received.

Others in the industry who have worked with Mr. Butler on his program are E. F. Hawkesworth, of the Southern California Gas Co., who has headed a special study on the use of fork lift trucks in the industry, and Paul Hughes of the Southern Counties Gas Co., who has done considerable work on utilization of storeroom space.

A program of standard packaging, headed by Les Michelsen of Peoples Gas, is under way and partially completed. Simplified Practice Recommendation No. 248-52, covering those companies that prepare items in standard packages, has already been accepted by the industry committee. A stopcock packing program has been approved by the committee and is ready for industry application. A standard code for packaging pipe couplings is now in the process of approval through Mr. Michelsen's efforts.

Carl H. zur Nieden, in his work on "exempt" materials, has taken a long step toward simplification of methods in the stores department.

portation and storeroom people can and should be put to use by any and all departments in the company. In fact, in an integrated operation, storing and handling people need the cooperation of all departments in the company if the greatest good is to be realized from their knowledge and experience in the field.

Often ignored

Too often the storing and handling function is ignored by those in the industry who are not directly associated with transportation and warehousing. This can no longer be the case in a modern and up-to-date operation. Storing and handling of materials is a horizontal rather than a vertical activity that cuts across departmental lines to become a company-wide function requiring an interdepartmental approach and cooperation.

No department is immune from the responsibility of examining its own storing and handling problems insofar as they add to or detract from the operation of the department or the company as a whole.

It is encouraging to note that recent months have seen the broadening of efforts toward better handling and storing practice in the industry. Association activities have taken a lead in this respect and their efforts are beginning to bear fruit.

Although many of the methods and techniques applicable to industry in general are also applicable to the gas utility, there are notable differences in approach that must be taken into account. These differences require an individual approach that can only be made by persons closely associated with the requirements of a gas utility. In other words, the gas industry, like any other industry, has its materials handling problems but, unlike industry as a whole, the problems of the gas industry are specialized. With the exception of appliances, it is not the salable product that is handled but the materials that go into the transmission and distribution of the product. Its problems require specialized treatment, in addition, because of the public interest involved in the operations of a utility and because of certain specialized requirements with respect to continuity of service.

The importance of the materials handling and storing activity in the gas industry may be examined in more explicit terms. Why, specifically, is it of sufficient importance to warrant careful consideration? What are the improved techniques for handling and storing and how have they been put to use to improve the overall operation of the company? What is being done to develop improved techniques and how are these techniques being made available to the industry as a whole?

Reasons for importance

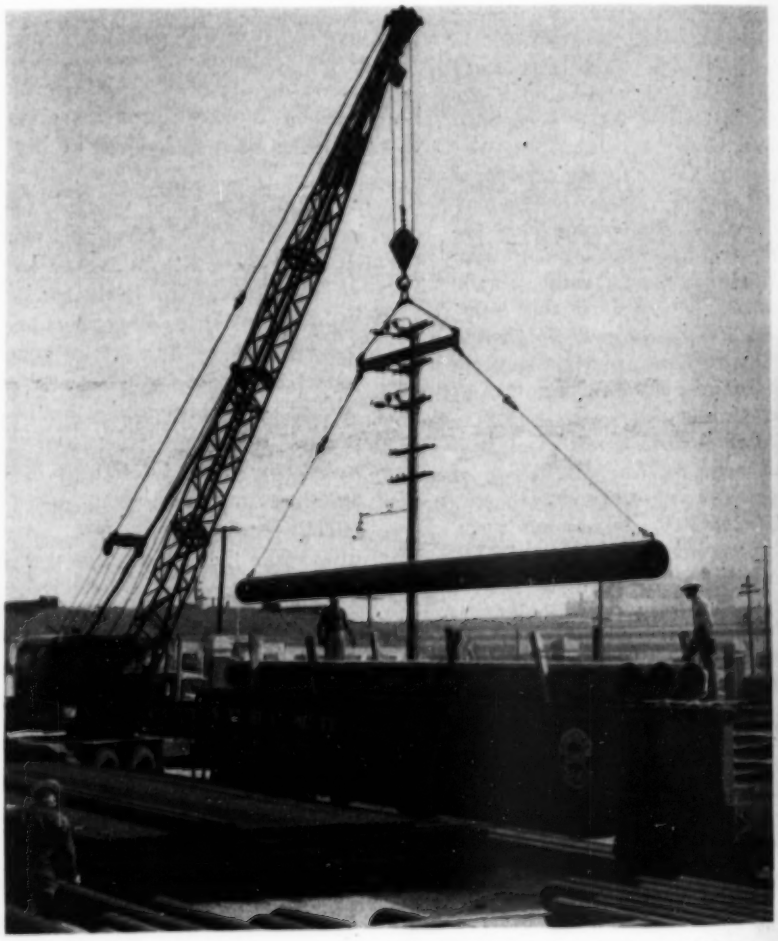
In the first place, the storing and handling of materials is an important activity because of its scope, because of the number and extent of the departments involved, and because of the number of persons engaged in the activity. It is important because of the amount of money with which it is concerned. In summary it is important because it is big business.

Materials handling is big business

Generally speaking, the major portion of the storing and handling activity takes place in the company's warehouses and storage yards. The usual practice is to maintain a central storeroom and central storage yard with a number of divisional or regional storerooms and storage yards. The number and size of both central and divisional facilities will depend upon the size of the company, whether or not appliances are handled or distributed, and the size and configuration of the area that is served.

A gas distribution company will generally provide sub-storerooms at all division offices. If the service area is divided into two or more major service areas, a large storeroom may be provided for each of the areas with an array of sub-storerooms in each service area.

A transmission company will usually store materials at each of its compressor stations. In addition, some arrangement is usually made for a central storeroom with sub-storerooms at points



SoCal has about 15 acres in its central pipe storage yard. Here a 20-ton Lorain crane is loading 30-in. pipe in the yard.

along the line. The length of a transmission line as against the area of a distribution network makes for the difference between the materials control problems at a distribution and a transmission company.

The number of persons involved and the number of man-hours expended in the handling and storing of materials in either type of company is a hard figure to develop. Outside of the transportation and storeroom departments, hardly anyone is solely engaged in the handling or storing of materials. On the other hand, however, of the operational personnel—those actually engaged in the production, transmission, or distribution of gas—there is hardly a person who does not spend a portion of his time in some phase of the storing and handling activity. The amount of this time and its cost can only be approximated.

One set of figures that can be developed to indicate the scope of the materials handling activity consists of the figures that represent the amount of materials handled, the number of persons directly and solely involved in the handling activity and their cost, and the amount of space devoted to handling and storing. In analyzing these data, however, it must be borne in mind that their magnitude is directly proportional to the size of the company. It must also be remembered that those companies that handle gas appliances will have considerably more space and a greater number of persons devoted to storing and handling than a utility of equivalent size that does not distribute appliances. Total handling costs will, of course, be higher with the company that handles appliances.

A significant example of the expanse of the materials handling and storing activity in a large gas utility is shown in the case of the Lone Star Gas Co., which operates a total of 186 warehouses throughout its widespread service area. The Lone Star Gas Co. is one of those companies that do store and distribute gas appliances.

In its Dallas division alone, Lone Star has three major storerooms with a total of nearly 50,000 sq ft of inside space and 150,000 sq ft of yard area. This division of the company operates in the metropolitan Dallas area and serves approximately 160,000 residential consumers, 12,000 commercial customers, and 600 industrial customers.

The total value of materials carried in stock in the Dallas division storerooms is approximately $1,250,000. Of this, approximately $600,000 is in pipe, $100,000 in pipe fittings, $300,000 in major appliances, and $100,000 in appliance installation materials and minor appliances. The remaining $150,000 is made up of various items such as cocks and valves, mechanical pipe fittings, and items of this nature. Residential meters are not included as they are charged to investment.

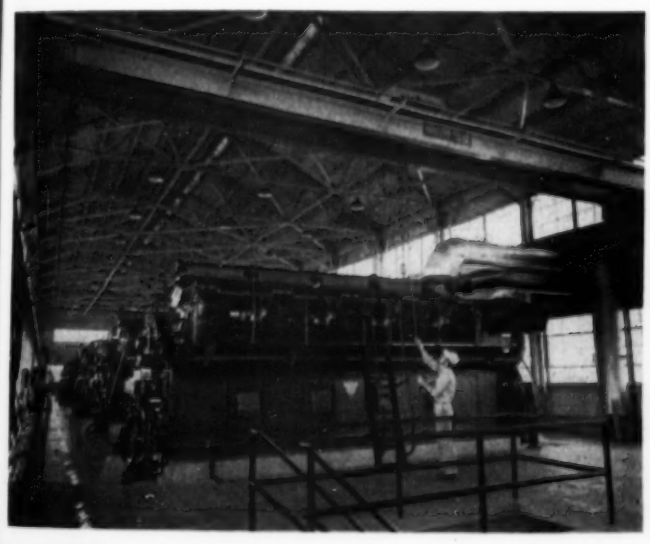
Materials issued from the three Dallas storerooms average about $225,000 per month, with some months as high as $315,000 depending upon the season of the year and work in progress. A total of 49 persons, including supervisors, clerks, janitors, etc., are engaged in the warehousing activity at the three Dallas storerooms at a total monthly labor cost in excess of $12,000.

The Peoples Gas Light & Coke Co., Chicago, which also handles and stores appliances, used approximately 26 storerooms. The central stores building is six stories high and has four storerooms. The company has about 155,550 sq ft of inside storage space and 177,700 sq ft of outside storage area. There are more than 50 persons directly engaged in the storing and handling of materials at an average monthly labor cost of approximately $18,000.

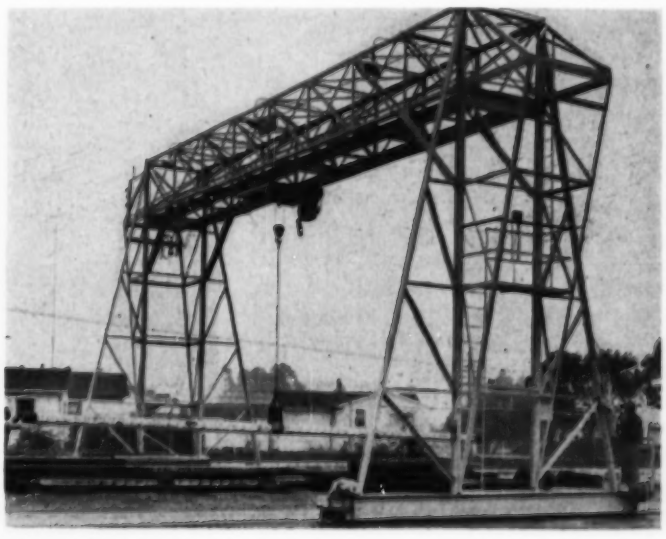
Storeroom personnel at Peoples Gas load for delivery between 25,000 and 35,000 gas-burning appliances each year. In dollar value this amounts to a monthly issue from stock of about $300,000. Their monthly issues of pipe and fittings amount to between $200,000 and $225,000. The total average monthly dollar value of issues from stock, including appliances, amounts to approximately $550,000.

An indication of the all-inclusiveness of the storing and handling activity can be had from the fact that People Gas handles about 33 million IBM office machine punch cards each year for its accounting department. With 10,000 cards to each 65-lb carton, this amounts to handling 100 tons of punch cards per year. A total of 5000 sq ft of storage space in the central storeroom building is devoted to stationery and office supplies.

The Southern California Gas Co., Los Angeles, which does not handle appliances except for demonstration and



Heavy overhead traveling cranes, such as this 3-ton Chisholm-Moore model at a Southern Natural compressor station, are used to put compressor engines into place and for handling engine parts during maintenance.



Typical of big handling equipment is this Spanmaster 3-ton gantry crane handling large quantities of pipe at Coast Counties Gas & Electric Co.'s new district operating depot in Santa Cruz, Calif.

promotional use, has a total of 90,000 sq ft of space allotted to the storing and handling of materials. The company has about 15 acres in the central pipe storage yard.

The company's central storeroom alone stores and issues approximately 9000 different individual items. Material issues from the central storeroom represent a dollar value in excess of $600,000 each month. The inventory has a current average monthly balance in excess of $3 million.

To receive and issue this amount of stock from central stores the Southern California Gas Co. employs 47 men and six supervisors at an average monthly direct labor cost of $17,600. Eleven substores in the central division only employ 22 men and one supervisor at an average monthly labor cost of $8100.

In its newly completed Tulsa service center, the Oklahoma Natural Gas Co. has a total floor area of 63,000 sq ft with about 5600 sq ft of dock area and 100,000 sq ft of outside pipe storage. This unit maintains an inventory of about $800,000 and handles over $255,000 in materials each month. The center employs a total of 23 persons. (See *GAS*, December 1953, p. 57.)

The Washington (D. C.) Gas Light Co. has a total of 46,600 sq ft of enclosed storeroom area and 257,500 sq ft of yard storage area. Approximately 15 fulltime employees are engaged in the storing activity. For the 12 months ending in August 1953, the total dollar value of its inventory was close to $1 million, with average monthly issues from stock during the same period running in the vicinity of $115,000. These figures do not include appliance or transportation stock.

Transmission experience

The experience of a gas transmission company differs considerably from that of a distributing company in the type of material handled and the methods of handling. The Northern Natural Gas Co., Omaha, for example, during 1953 purchased and handled over $15 million worth of 30-in. pipeline pipe. This material was used on a new line that also included 41 pipeline valves, which cost more than $10,000 each. They weighed 6 tons each and were shipped three to a freight car. Six gas-driven turbines, included in the year's program, were handled as a part of the construction program. The company owns and operates 410 trucks and handles some 800 tires each year to keep its automobiles and trucks in repair.

Such unusual items as porpoise jaw oil used for oiling meter clocks, carloads of rice-sized salt used in water softeners in compressor stations, snake bite kits for field personnel, blankets, cots, insect repellent, ear defender plugs, and dramamine tablets are stored and handled by storeroom personnel in a large transmission company.

Each gas transmission line compressor station must have some provision for handling the heavy parts of compressor engines and other similar auxiliary equipment. This is an example of a major handling job which is not ordinarily associated with the work of the stores department and, for this reason, not included in the labor cost estimates of this department. Nonetheless, it is a handling job that makes use of equipment and techniques that are familiar to the store's personnel.

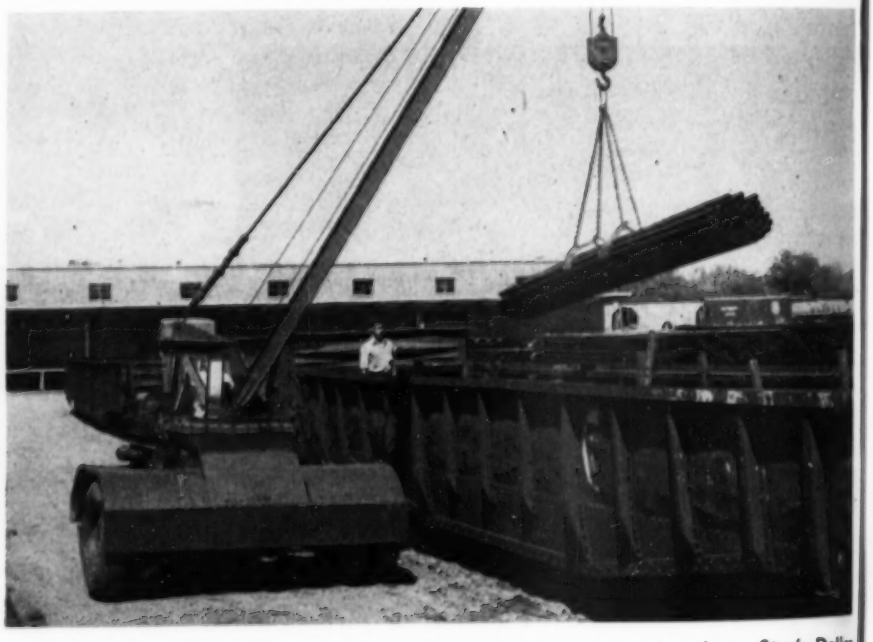
Compressor stations are usually equipped with heavy overhead traveling cranes that are used to put the compressor engines into place and for the handling of engine parts during maintenance. Heavy-duty overhead hoists may be satisfactory for some of the smaller compressor installations. Overhead hoists are also used in auxiliary engine buildings, compressor station storage and machine shops, water treating buildings, and in other station buildings.

The "bigness" of the materials handling and storing activity in the gas industry, therefore, is indicated in this random tabulation of the average dollar value of monthly issues from stock, the amount of space devoted to the facility and the manpower involved.

Unlike a manufacturing concern that receives raw materials from which it fabricates a product, a gas utility must receive all materials that it issues. What is more, these materials are received in basically the same form in which they are used. Assuming that the materials received by a gas company are handled only twice—once on receipt and once on issue—this means that the dollar value of materials handled in one month is at least double the dollar value of the average monthly issues from stock. In other words, whereas the usual industrial concept of materials handling is in terms of goods shipped or raw materials received, in a gas utility the dollar value of the average monthly issues from stock indicates the dollar value of the materials received, handled, stored, and issued in an average month.

Big investment

With investments as high as several million dollars, depending upon the size of the utility and whether or not it handles appliances, it is not unreasonable to expect the average monthly dollar value of materials handled in and out of stock to exceed $1 million. Utilities of medium size will handle approximately $500,000 worth of materials in an average month. This is a conservative figure because it does not include the handling of meters in and



A Hughes-Keenan Roustabout crane similar to this one is used in Lone Star's Dallas division pipe yard.

This length of 30-in. pipe is being handled by a 9-ton Gerlinger fork lift truck at SoCal's pipe yard.

out of service on the regular inspection cycle, which is one of the big handling jobs done by storeroom personnel.

In handling this bill of goods each month, the average utility used hundreds of thousands of square feet of storage area, upwards of 100 persons in the larger companies at an average monthly labor cost of several thousand dollars and a wide variety of materials handling equipment.

With respect to manpower, the above figures do not include any office personnel involved in the handling operation or the many employees who spend a portion—often a considerable portion—of their time in the handling operation. The service installation man who carries a meter from a truck to a house for installation or removes a meter from service and returns it to division headquarters is not included in the figure although a good part of his work is concerned with the handling of materials and the cost of his duties to the company are based partially on the time he spends in handling meters.

The figures do not include compressor station employees who haul stone or lift and otherwise handle pipe and fittings and various compressor and engine parts. The men who helped to unload and install the six compressors on Northern Natural's new line, for example, were not included. The figures do not include the men in the maintenance truck who constantly handle all kinds of pipe and fittings, and they do not include office personnel who must move stationery, punch cards —the whole 100 tons each year in the case of the Peoples Gas Light & Coke Co.—and all kinds of office supplies from place to place within their own offices.

The handling equipment

With respect to handling equipment, the gas industry stores people use everything from conveyor belts to large cranes in their handling operation with the versatile fork lift truck being used in the handling of all kinds of storeroom materials.

Heavier equipment for pipe

Pipe yard handling, one of the gas industry's major handling jobs, is done with the heavier equipment such as cranes and heavy-duty fork lift trucks. At the present time mechanized equipment is used almost solely for handling pipe of all diameters. In those yards where pipe wrapping is done there is need for additional mechanized equipment to move the pipe about the yard.

Oklahoma Natural has one new 9-ton Unit crane and two crane cars in use at the Tulsa service center for handling pipe. The company also uses one Unit crane and one crane car in the Oklahoma City pipe yard. The Southern California Gas Co.'s central pipe yard, where the company wraps all diameter pipe, has two 20-ton Lorain Motorcranes and one 7½-ton Lorain truck-mounted crane in use. The yard also has a 9-ton Gerlinger fork lift truck that can handle up to several lengths of 30-in. pipe. Three 2-ton fork lifts are used for various other jobs about the yard.

Southern Counties Gas Co. uses a 15-ton Link Belt Speeder, rotary boom crane for handling pipe at its central yard. Storeroom handling is done with Towmotor fork lift trucks.

At Lone Star's North and Oak Cliff storerooms in Dallas, pipe is stored in covered yards and handled with P and H 2-ton overhead traveling cranes. A Hughes-Keenan Roustabout crane is used in another Dallas division pipe yard.

Peoples Gas uses one crane at each of its pipe yards. A gantry crane is used for pipe handling at Coast Counties Gas & Electric's new Santa Cruz (Calif.) operating depot.

The experience of the Ohio Fuel Gas Co. toward mechanization in its handling operation exemplifies that of the industry in general since World War II. During this period construction of pipelines from the southwest opened new natural gas areas and poured new supplies into established areas. Like other Columbia Gas System companies, Ohio Fuel embarked on a tremendous expansion program.

Mechanization necessary

Manpower availability and its mounting costs per hour made the mechanization of many construction operations mandatory. This same situation extended to maintenance operations such as sectional replacement of piping in towns, as well as excavating for leak repairs and taps for new customers.

To meet some of the requirements Ohio Fuel purchased in 1946 its first rubber-tired crane for work in distribution. The success with the first machine in opening holes, unloading pipe, low-

The fork life truck has many uses in the industry for handling all kinds of storeroom materials. Here a Yale truck is being used to load meters.

This hand truck used by Consolidated Edison of New York not only makes meter transportation easier, it also protects the meter.

ering pipe into the ditch and many other operations quickly indicated the economics of such equipment. After considerable study a Schield Bantam crane on 6 x 6 prime mover was purchased in the spring of 1949 for the pipeline department for country use. On basis of experience with this machine, it was decided each pipeline division should be equipped with a similar machine. Accordingly, one additional machine was purchased in 1950 mounted on a half track and in 1951 two more machines were purchased for pipelines, one of which also was a half track.

These machines are used for digging and backfilling bell holes for leak repairs, minor construction, stripping pipe for inspection and sectional replacement, plus the other obvious pipe handling work. Occasionally clamshell and drag line work is required and the Schield Bantam handles these assignments nicely.

In 1951 two Schield Bantams on 6 x 6 chassis were purchased for distribution, one for compressor department and one for central repair shop. In 1952 another machine was purchased for use in a large warehouse location at Sugar Grove.

The distribution machines also are used for maintenance work, opening bell holes, stripping pipe, etc., in addition to opening holes for pipe-pushing machines and boring machines, digging trench where ditcher cannot be used or where depth makes backhoe work necessary. Handling of pipe from cars, loading off pipe piles, stringing, positioning for welding, lowering in, etc., are other functions of the machines.

Busy machines

In compressor station use the handling of heavy material formerly requiring erection of a gin pole, digging excavations for foundations and footers keep their machine busy covering the construction in the northern part of Ohio.

The two machines purchased for warehouse and pipe yards have demonstrated their ability to unload pipe, move pipe piles, load trucks and handle heavy material. Rate of unloading cars is a function of the number of pieces of pipe in a car, the personnel available and organization of the racks with relation to pipe being unloaded. It can, therefore, be seen that a flat statement of capabilities is impossible to defend.

Inside storing

For inside storing there is a decided trend toward the complete palletization of all materials. The gas industry has lagged behind industry in general in adopting this method of materials control. Although the palletization of materials is not a cure-all, it is a step in the direction of better handling, and the program of modernization is under way. In one respect the gas industry has been slow in adopting a policy of palletization because of the unusual size and shape of materials handled. Experience and the exchange of ideas have now solved this problem, and it will be only a matter of time until the practice will be in just as widespread use in the gas industry as it is now in private industry.

Complete palletization

An outstanding example of complete palletization is the procedure used at Oklahoma Natural's Tulsa service center, where all materials are stored on pallet racks and issued on pallets. Another is the program at Southern California Gas, which goes as far as to provide some of its suppliers with pallets or wire basket containers so that materials received are already palletized.

Palletization of residence meters is used at Oklahoma Natural's Tulsa service center, which also boasts of one of the first assembly line meters shops in the industry. A conveyor belt that can be controlled by any one of the several repairmen along the line is used to carry meters through the conditioning operation. (See "Production Line Speeds Meter Repair at Tulsa Shop," February *GAS*, page 42.)

Three fork lifts

In Chicago, Peoples Gas uses three fork lifts at the central storeroom and 4000-lb hydraulic hoists at each substoreroom. One fork lift at the central storeroom is used almost solely for loading and unloading major gas appliances.

Left: A Hyster fork lift truck in action at Lone Star's Fort Worth warehouse. **Right:** At Oklahoma Natural's Tulsa service center, all materials are stored on pallet racks and issued on pallets. Here is a view of palletized valves.

The use of wire basket type handling equipment called Cargotainers and Palletainers as a method of handling residential meters has resulted in improved service and a more economical operation in several instances throughout the industry. SoCal has put them to use in transporting meters from sub-storerooms or division offices to and from the central meter repair shop. The same equipment has been put to use in Tulsa for meter handling. However, the use of this kind of container is not, by any means, restricted to meter handling.

Michigan Consolidated Gas Co. uses Palletainers for all small and bulky materials, and Southern California Gas presently uses 2200 wire basket type containers (both Cargotainers and Palletainers) for the dispatch of all kinds of materials between storerooms.

The cost of materials handling

The vast amount of material received, stored and issued by a gas utility, and the cost of space and expenditure for labor involved in materials control, point out a second reason why it must be given careful consideration in any modern operation. Both the cost of labor and the cost of space used in the handling and storing operation are to be considered expense items that can be brought under control through the application of good methods.

Materials handling is important, therefore, because it involves a substantial operating expense.

An exact estimate of the amount of expense involved, as in the case of the manpower expended in handling, is a hard figure to develop. The materials handling cost figure that is added to all construction jobs as a flat percentage of the total estimated cost of the job will probably give the most usable estimate.

Currently this materials handling charge is varying between 10% and 20% of the total cost of the construction job. Even at the lower percentage, this represents a substantial expenditure of money. Nevertheless, it is a conservative estimate because it includes only those charges made to the job by the stores department and does not include any of the numerous handling costs which arise outside of this department.

Although this percentage varies widely from company to company because of the method by which it is computed, it does indicate the relative magnitude of the handling expense in an average company. It is an authentic figure because it is corrected at the end of each year to express the exact expenditures incurred by the handling departments in terms of the year's total construction expense.

The cost of materials handling is an expense that does not change the article handled in any tangible manner while it can at the same time add to its value. As a basic principle this expresses the difference between the materials handling process and the manufacturing process. A length of pipe, a valve or a fitting is not changed in any tangible way by the expenditure of money in moving it from the storeroom to the field where it will be put to use. Nevertheless, its value is considerably greater in the field than in the storeroom.

It must be pointed out, however, that any more than the minimum required amount of handling will add cost without value to an article. The important consideration is a thorough understanding of this basic principle of materials handling and an appreciation of the fact that cost without value can be added to an article through unnecessary handling.

Each time an article is moved there is expense involved. If the expense adds appreciably to the value of the

GAS EXEMPT MATERIAL – ISSUE
456-82578 Rev'd. 5-52

Requested By _____ Truck No. _____

Account No. 131-444 Storeroom _____ Date _____ Ticket No. _____

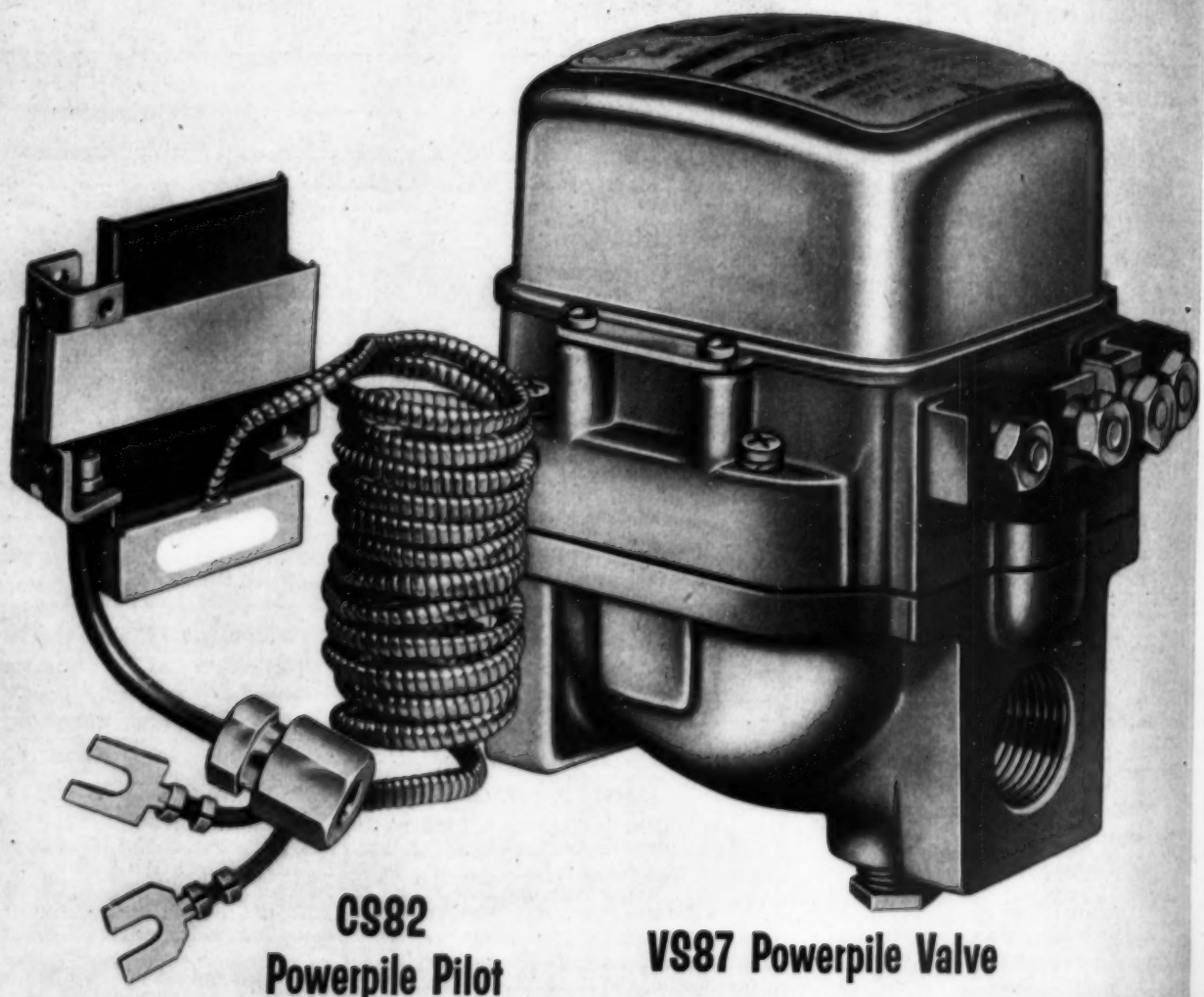
QUANT.	CODE	ITEM	QUANT.	CODE	ITEM	QUANT.	CODE	ITEM
	419-47876	3/4 x 4 1/2 E.H. Weld. Nipple		447-46428	3/4 x Close Galv. Nipple		447-70903	1/2 Galv. Tee
				46430	3/4 x 2 " "		70904	3/4 " "
	447-07653	1/2 x 3/8 Galv. Bushing		46432	3/4 x 3 " "		70906	1 1/4 " "
	07656	3/4 x 1/2 " "		46434	3/4 x 4 " "		70908	2 " "
	07660	1 x 3/4 " "		46436	3/4 x 5 " "		70558	3/4 x 3/4 x 1/4 " "
	07663	1 1/4 x 3/4 " "		46438	3/4 x 6 " "		70561	3/4 x 1/2 x 3/4 " "
	08603	3/4 " Cap		46439	3/4 x 7 " "		70562	3/4 x 3/4 x 1/2 " "
	08605	1 1/4 " "		46440	3/4 x 8 " "		70579	1 1/4 x 1 1/4 x 3/4 " "
	14568	3/4 x 2 1/8 Weld. Coupling		46445	1 x Close " "		70701	3/4 " Sor. "
	14778	3/4 Galv. "		46447	1 x 2 " "		70703	1 1/4 " " "
	14854	3/4 x 1/2 " "		46449	1 x 3 " "		70804	1 1/4 x 1 x 1 1/4 " " "
	14855	1 x 3/4 " "		46451	1 x 4 " "		72161	1/2 " Union
	14856	1 1/4 x 3/4 " "		46453	1 x 5 " "		72162	3/4 " "
	14934	3/4 Sty.90 Drsse. "		46455	1 x 6 " "		72163	1 " "
	14935	1 1/4 " " "		46462	1 1/4 x Close " "		72164	1 1/4 " "
	20503	3/4 - 45° Galv. Ell		46463	1 1/4 x 2 " "			
	20553	1/2 Galvanized "		46465	1 1/4 x 3 " "		449-35104	5A & 10A Meter Hanger
	20554	3/4 " "		46467	1 1/4 x 4 " "		35106	20A " "
	20555	1 " "		46469	1 1/4 x 5 " "		35107	30A " "
	20556	1 1/4 " "		46471	1 1/4 x 6 " "		35662	1 x 8 Pipe Hook
	20558	2 " "		46472	1 1/4 x 7 " "		35663	1 1/4 x 6 " "
	20603	1/2 " Sor. "		46473	1 1/4 x 8 " "		57101	1 1/4 grass Screws
	20604	3/4 " " "		46475	1 1/4 x 10 " "		59611	3/4" Lead Wire Seal
	20605	1 " " "		46494	2 x Close " "		62205	5A Meter Shelf
	20606	1 1/4 " " "		46498	2 x 3 " "		62206	10A " "
	20608	2 " " "		46500	2 x 4 " "		62207	20A & 30A " "
	20610	1 1/4 Sty.90 Drsse.Sor. "		46502	2 x 5 " "		69005	5A " Union
	20654	3/4 x 1/2 Galv. "		46504	2 x 6 " "		69006	10A " "
	20656	1 x 3/4 " "		52103	1/2 Cast Iron Pipe		69014	20A " "
	20657	1 1/4 x 3/4 " "		52105	3/4 " " "		73000	30A " "
	46416	1/2 x Close " Nipple		52106	1 " " "		76009	5A " Washer
	46419	1/2 x 2 " "		52107	1 1/4 " " "		76015	10A " "
	46421	1/2 x 3 " "		52109	2 " " "		76016	30A " "
	46423	1/2 x 4 " "					76027	20A " "
	46425	1/2 x 5 " "						
	46427	1/2 x 6 " "					439-36936	3/4 Galv. Perf. Strapping

Exempt materials issue form used by Philadelphia Electric Co. (See page 72).

The new All-Honeywell Powerpile Systems

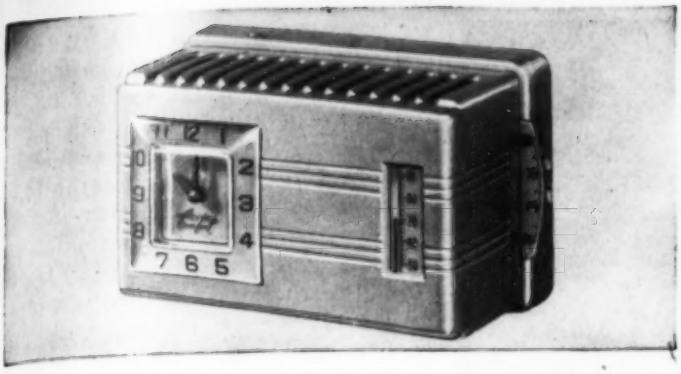
give you...blue flame pilot that uses no primary air...

40% more power with half as much gas!

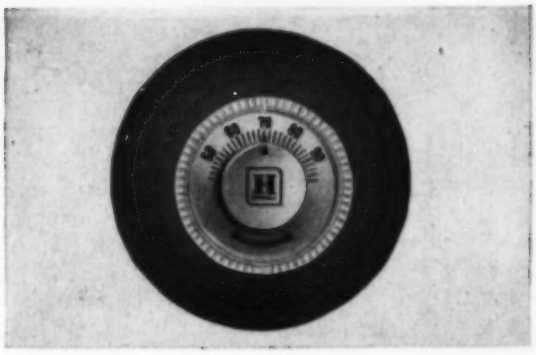


C582
Powerpile Pilot

VS87 Powerpile Valve

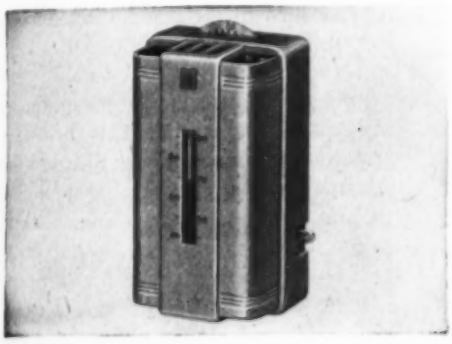


Y400D Powerpile Package includes the TM850 Chronotherm which has the famous electric clock that *automatically* turns the heat down at night ...and raises it again in the morning for 24-hour comfort control.

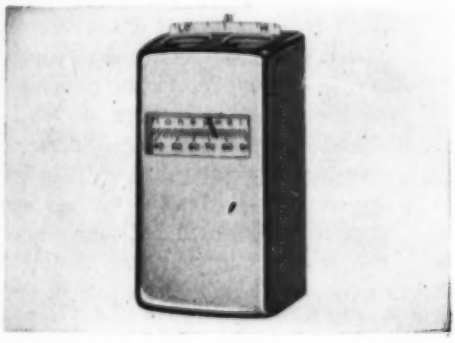


Y400E Powerpile Package includes the new Honeywell Round (TS-86) with mercury switch, and a built-in heat "cycler" to smooth out temperature fluctuations.

Y400C Powerpile Package includes the TM801 Time-O-Stat which works like an alarm clock—it *automatically* turns up the heat each morning.



Y400B Powerpile Package includes the T804B Thermostat with mercury switch—a built-in heat "cycler" smooths out temperature fluctuations.



Y400A Powerpile Package includes the TS827 Thermostat. It has a mercury switch and extra convenience features to provide for economical temperature control.

The Y400 packages are completely new, self-powered control systems . . .

- ***No Primary Air.*** The Powerpile requires no primary air intake, yet burns with a typical blue flame—no lint screens . . . no adjustments.
- ***Uses Less Gas.*** Revolutionary new, silent pilot *uses less than half as much gas as other pilots.*
- ***For All Gases.*** This one Powerpile Unit is used for all gases—only the orifice changes, and one of the three orifices available is suitable for *all street gases*. For LP application, one orifice is suitable for either propane or butane, and a complete line of 100% shut-off Pilotstats is available.
- ***Simplicity.*** You'll really go for the simplicity of this Powerpile Unit. We've completely minimized ordering, stocking and handling with this single, universal model! And since the flame that produces the system operating current also ignites the main burner—there are no separate ports, no carry-around slots to add to servicing troubles.
- ***Large Valve Ports.*** The silent valve has larger ports than any other domestic diaphragm valve, and is less subject to clogging. Available in sizes from ⅜" through 1".
- ***Wide Range of Thermostats.*** A wide range of thermostats can be used with these systems—you can please *all* your customers!

For complete information on the new Honeywell Powerpile Packages, and on the complete line of Honeywell Controls, write Minneapolis-Honeywell, Dept. GS-4-81, Minneapolis 8, Minnesota.

MINNEAPOLIS **Honeywell**

112 OFFICES ACROSS THE NATION

First in Controls

These steel palletainers are used by Michigan Consolidated Gas Co. for storing bulky items as well as packaged materials. Palletainers in background are easily stacked for packaged materials. Four collapsed palletainers are shown at left.

article, it can be termed a justifiable expense. If, on the other hand, there is insufficient increase in the value of an article with the expenditure of money for handling, the expenditure is not justified. The economies in time and money that can result from good practice in the materials handling operation—or the additional costs that can result from bad practice—are evident in the light of the vast amount of materials handled by the average gas utility.

There are many examples that can be used to show the economies that have resulted from the application of good methods of handling. A selection of sample cases taken from a cross section of the operation will serve to indicate the potential.

The handling of residential meters is a major problem for any gas distribution system. Because of this, it is the logical place to apply new and money-saving techniques. The size of the undertaking is indicated by the Southern California Gas Co., which has some 70,000 meters out of service at all times. These meters are either in storage, in transit or in the meter repair shop. Because all utilities are required to make a periodic inspection of their residential meters, this is a universal handling job of considerable size that must be done by stores personnel.

Careful consideration has recently been given by some distribution companies to the matter of meter handling and, as a result, there are instances that show how new techniques make a more economical and a more serviceable operation. In the case of the Southern California company, for example, a recent analysis of residential meter handling revealed that each meter was individually handled many extra times between its removal from service and its return to service after inspection. This individual handling of each meter resulted in unnecessary handling costs which added cost without value to the meter.

A study of the problem was undertaken and it was found that with the purchase of wire basket containers with rollaway skids and lift jacks, and the necessary fork lift trucks to handle and transport meters in units of 48 iron or 30 tin, a considerable saving would result. It is estimated, in fact, that approximately $15,000 a year could be saved in meter handling costs, and that the equipment required for the change could be paid for from savings in 4.86 years. With an equipment life expectancy of 10 years this would result in a net savings of $76,000 during the useful life of the equipment.

The analysis further indicated that savings realized by adopting the wire basket fork lift method of meter handling would affect costs currently chargeable to storeroom space, storage labor and interest on and depreciation charges to equipment used in the present method of handling.

In a similar instance Oklahoma Natural has put wire basket containers to use for handling meters in Tulsa. A separate fork lift truck is assigned to the meter shop for this new handling operation. Other distribution companies will likely follow suit. A program of standard packaging for the gas industry, which has been led by Les R. Michelsen of Peoples Gas, is another instance where improved techniques have resulted in substantial economies. The practice of standard packaging which has been undertaken at Peoples Gas, for example, has resulted in a 90% saving in the time required for inventory. It has also resulted in a saving of more than 30% in the floor space required for storage.

A packaged fitting program which provided for grouping fittings 2 in. and under in size into eight different standard sized cartons with a maximum allowable weight of 50 lb per carton was undertaken some time ago by SoCal. The program resulted in a reduction in both handling costs and storage area expense. The procedure was further modernized through the installation of two counting scales to permit rapid, accurate receipt of materials and to make the packaging of fittings a more practical operation. One large scale is used for receiving material and a smaller one to handle the packaging operation.

Several years ago the material and supplies committee (now the purchasing and store committee) of the AGA appointed a subcommittee to study the advantages of packaged pipe fittings 2 in. and less in diameter. The subcommittee found that barrels, burlap bags, and boxes that were used for shipping often contained several different types, sizes and kinds of fittings. It was also found that there was a lack of a uniform count in the containers; some were of excess weight, and there was poor identification of the materials. To properly report the receipt of materials under these conditions it was necessary for the receiving personnel to unpack, sort, count, and repack the contents in suitable containers or bins.

The subcommittee pointed out to the industry that substantial savings in storage space would result if fittings were shipped in standard packages. It was also pointed out that with the use of mechanized handling equipment there would be an additional saving in handling time. The saving in inventory time and the additional accuracy in receiving, disbursing, and inventorying materials was brought out as other ad-

*Natural or LP Gas

ALREADY A SMASHING SUCCESS IN THE ELECTRIC MODEL!

Over 60,000 Bendix electric Duomatics were sold in its first year . . . giving 60,000 housewives *complete* freedom from the drudgery of washing *and* drying clothes.

But 90% of Duomatic prospects in some areas are equipped for a *gas* model only. As a matter of fact, we estimate that *40%* of those who actually bought the electric Duomatic would have *preferred gas!*

The demand for gas was tremendous!

NOW BENDIX OPENS THE DOOR TO *MILLIONS* OF GAS DUOMATIC SALES! THINK OF THE BASE LOAD!

In a city of 100,000, 10% saturation would produce an annual new load of over 100,000,000 cu. ft.!

What's more, Duomatic owners launder often—as often as once or twice every day! This means more gas used for water-heating, too.

The Duomatic dries for them every time it washes—because it's all automatic. There's no on- or off-season—gas will do *all* their drying *all* year!

And the new Gas Duomatic has another great promise. It establishes *gas* as the truly modern *automatic* fuel—for what could be more dramatically automatic than a machine that washes and dries clothes all in one operation!

The Bendix Gas Duomatic Washer-Dryer will repay you lavishly for every promotion effort you invest in it. NOW is the time to establish GAS as the fuel choice for this fabulous new appliance!

BENDIX HOME APPLIANCES
AVCO Manufacturing Corp.
Cincinnati 25, Ohio

BENDIX HOME APPLIANCES
PIONEER OF WORKLESS WASHDAY

vantages of a packaging program. The committee also emphasized the manner in which proper weight would be an aid in accident prevention.

As a result of the efforts of the subcommittee, a standard packaged fitting program has been instituted, a program for standard packaging of stop cocks has been completed, and a new code for standard packaging of pipe couplings is now in process of being approved.

It can be shown that operational changes at management level in the stores department have resulted in a more economical operation of the department. For example, by placing certain accounting activities in the accounting department, rather than the stores department, a more serviceable as well as a more economical operation will result. Such duties as those that have to do with the preparation of adjustment advices covering errors in prices and quantities of materials invoiced by suppliers, the periodic report of the dollar value of capital tools and other similar auditing operations, should normally fall within the realm of the accounting department rather than the stores department. There are a great many borderline activities in the stores department that must be designated to one department or another according to the function of the particular organization. In any instance a functional alignment of activities will result in a more economical operation.

In another example the use of simplified methods for accounting for minor materials has resulted in substantial economies. In one large utility, for example, it was determined that during one month (selected at random) 41% of the number of items issued from stores cost less than $1 each and aggregated only $5000. This amount represents less than 1% of the total value of the month's issues of over $535,000. In other words, it was found that 41% of the effort was spent on 1% of the materials in terms of cost value. Only 59% of the effort was spent on 99% of the material in terms of value. In many instances it was shown that several dollars was spent for moving an article worth but a few cents.

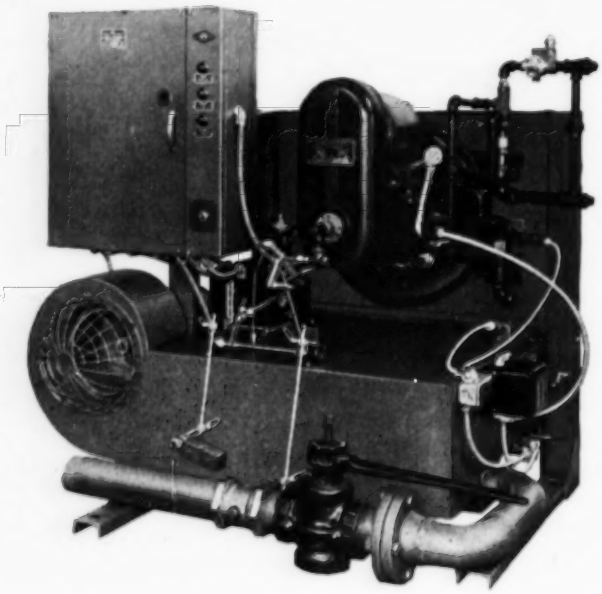
Additional analysis

In an additional analysis it was found that 60 out of 480 different kinds and sizes of materials constituted 76% of the number of items issued from stock during a two-month trial period. Additional inspection showed that 14 single items constituted 47% of the total item volume. Of these, 12 items had a unit cost value of less than 20 cents, and only one item had a unit cost value of more than $1. The 12 items cost $2750 in total and represented 45% of the total number of units issued. This is an indication that several times the cost of an item is in a good majority of the cases expended in the handling of the article.

A measure of improvement involves a study of all materials having a low unit cost with the thought in mind of reducing extensive reporting for inconsequential items. Consideration should be given to the rate of usage, the kind of jobs on which the material is used, and the degree to which the items are susceptible to personal use.

In a study undertaken by Carl H. Zur Nieden of the Philadelphia Electric Co., who has pioneered the theory of accounting for minor materials, a savings of 97% in the amount of accounting procedures was effected in his own company by instituting a practice of exempt materials. He points out, also, that exempt materials resulted in a saving in the local storeroom because of

WEBSTER ROTONETIC*



DUAL FUEL FIRING BURNER

- Sizes from 75 to 300 horsepower.
- Minimum gas pressure requirements.
- Low installation costs.
- Maximum efficiencies on BOTH gas and oil.
- Minimum base height requirements.
- Utilizes all grades of fuel oil.
- Extremely low noise level.
- Approved electronic combustion safeguard system.
- Simpler changeover than ever before.
- One hundred per cent forced draft.
- Completely assembled, piped, wired and tested.

These and many other outstanding features combine to provide the same dependable high quality performance as the WEBSTER DYNETIC gas burner. Neither fuel must suffer if the WEBSTER ROTONETIC is used. With integral pumps, integral oil preheaters for heavy oils, patented oil burner "flame-shaping" vanes, and full modulating or optional high-low control, the WEBSTER ROTONETIC is designed to provide long lasting customer satisfaction the year around.

It is furnished with a precast refractory front as an integral part of the burner assembly. The installer need only finish the furnace wall on each side and above the burner.

WRITE FOR LITERATURE
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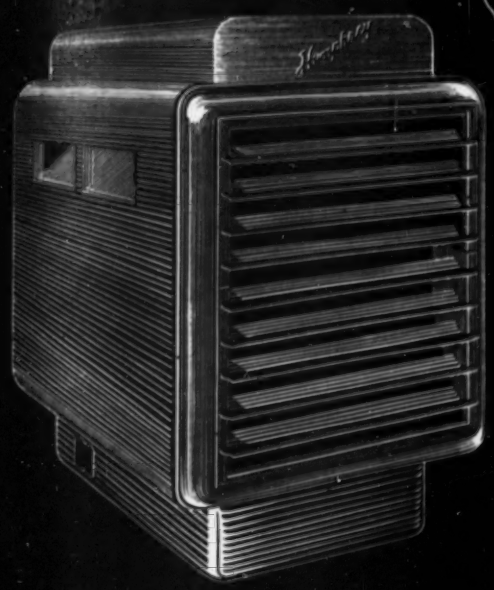
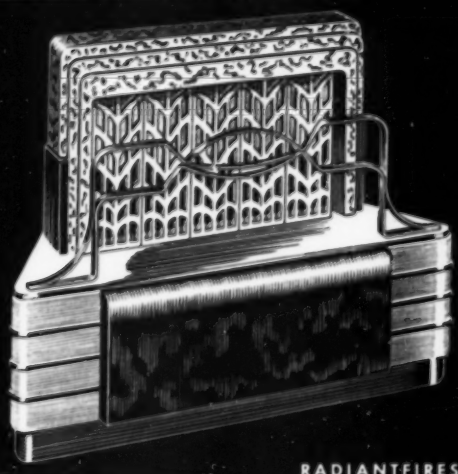
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

Backed by HALF A CENTURY OF LEADERSHIP . . . IN STYLING . . . ENGINEERING and SALES APPEAL

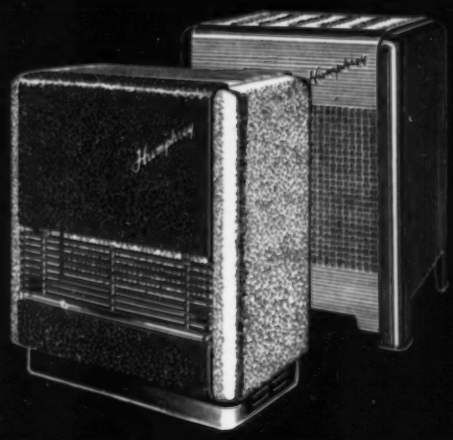
Humphrey gas heating equipment



AUTOMATIC GAS UNIT HEATERS



RADIANTFIRES

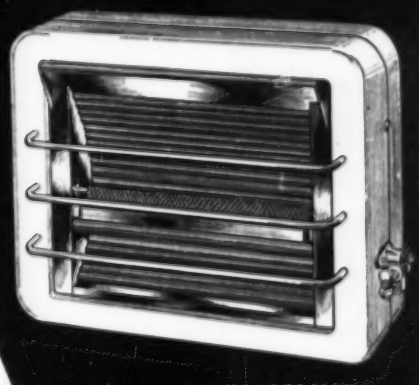


ROYALINE AND RADIANTFIRE CIRCULATORS

There is something about every Humphrey Gas Heater that makes it distinctly different . . . distinctly recognizable as a Humphrey product.

You notice the difference, first, in the handsome styling and rich finish of Humphrey Heaters. You see it, too, in the many exclusive engineering improvements built into the Humphrey. Most of all, you sense Humphrey superiority in the perfection of every construction detail, inside and out.

Because the Humphrey line has been the leader in the gas heating field for more than fifty years, this line is the preferred choice of dealers who handle the most dependable, most saleable products.



WALL HEATERS

HUMPHREY PRODUCTS

GENERAL GAS LIGHT COMPANY • KALAMAZOO, MICHIGAN

23 WARREN STREET, NEW YORK CITY 2ND UNIT SANTA FE BUILDING, DALLAS 225 ELEVENTH STREET, SAN FRANCISCO

the reduced posting to the local stock record cards as well as a reduction in the handling of this type of material.

In the simplified accounting such as that used at Philadelphia Electric, "exempt" material is not charged individually to the job in the same manner an "non-exempt" material. Exempt material is accounted for by means of loading each applicable gas capital and appliance installation with a predetermined fixed dollar value loading on each service, regulator, meter, and appliance installation. This loading equals the total value of the average amount of exempt material used on each type of installation. The exempt material used on gas maintenance work shall be applied to the various maintenance accounts on a percentage basis, using as 100% the balance remaining in the "Exempt Materials Account" after all charges for new installations have been deducted.

Exempt materials are purchased as a storeroom item, charged to a material and supply account, and held there under the individual code numbers of the material until issued from the storeroom to the foreman upon presentation of an "Exempt Materials Issue" form. Likewise, transfers of this material are made between storerooms while in the regular materials and supplies account. Exempt materials are not listed by the estimator on work instruction authorizations as each truck carries a supply of such materials, which it is the foreman's responsibility to replenish daily or as required. The tremendous reduction in time and effort that results from such a method is obvious.

Loading palletized meters onto a truck from a hydraulic lift at one of SoCal's warehouses.

These examples show how a more economical handling and storing operation has actually resulted from improved methods. Because of the press of other matters the gas industry has been late in getting started on this program of modernization in its stores departments. Many companies are still reluctant to adopt new methods and, as a result, lag behind industry as a whole in their handling procedures. It is encouraging, nevertheless, to see examples of modernization through mechanization and the adoption of improved techniques that have led to a better operation in the more forward looking companies.

The service in materials handling

Materials handling, however, is so much a company-wide undertaking that caution must be exercised with any measures affecting economies within the stores department. An economical operation is by no means the only standard by which the stores department must be judged. Since the materials

Insist on...

PROTECTO WRAP

Cold Coating

FOR COATING AND WRAPPING UNDERGROUND OIL AND GAS PIPELINES-

Protecto Wrap Cold Coating provides hot applied enamel quality of material and workmanship on oil and gas pipelines. It is particularly recommended for reconditioning, and for field joints and repairs to coating.

Protecto Wrap Cold Coating is applied in two steps with the following described materials — either asphalt or cold tar base depending upon adjacent coatings.

1. Protecto Wrap Cold Coating Primer consists of a heavy bodied bituminous coating that is applied by conventional brushing. Care should be taken to thoroughly fill all pits on reconditioned pipe with primer.
2. Protecto Wrap Cold Coating consists of a woven glass textile cloth saturated with asphalt or coal tar pipeline enamel. This coating is applied by spiral wrapping over the primer while it is still wet.

Our sales representatives are available to demonstrate this material and method. Address orders or inquiries to our nearest sales office or to P. O. Box 82, Englewood, Colorado.

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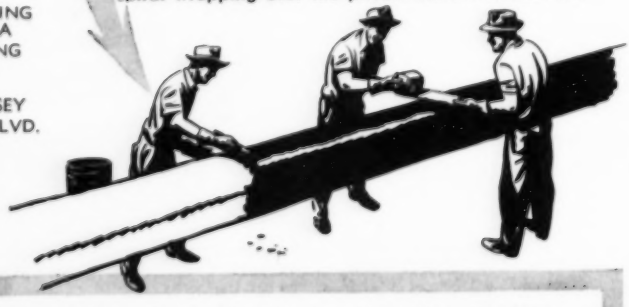


PROTECTO WRAP COMPANY
ENGLEWOOD, COLORADO

control

Installers like it too. Not only will the appearance of the G-7 sell more water heaters, but it has real practical utility as well. Rotational reset, an exclusive feature, is easier than the old push-button method—concealed extra-capacity pilot filter—separate body and shank construction—extreme simplicity of operation for the home owner. The G-7 provides 100% safety shutoff for all gases including LPG. Write for further information today on the G-7—the world's finest water heater control.

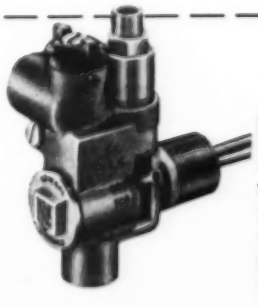
GENERAL CONTROLS

Plants in: Glendale, Calif., Burbank, Calif., Skokie, Ill.
Factory Branches in 37 Principal Cities
SEE YOUR CLASSIFIED TELEPHONE DIRECTORY

Manufacturers of Automatic Pressure...Temperature...Level and Flow Controls for Heating...Home Appliances...Refrigeration...Industrial and Aircraft Applications

G-2 Standard Model

100% safety shutoff for all gases including LPG is provided by this all-in-one safety and water temperature control. Operated by a single, rotating dial, the G-2 features high gas capacity, simplicity of design and positive safety also under all operating conditions.



G-4 Economy Model

Accurate temperature control is featured in the main burner shutoff control for all city gases. Compact, serviceable, with one dial for pilot-lighting and flow control, this unit has a fine performance record in the water-heater control field.

handling department is basically a service department, all procedures must be analyzed with respect to the manner in which they alter the service rendered to the other departments of the company. This aspect of the materials handling operation is of first importance. The end result to be aimed for is an improvement in service to the company and more than likely the overall company saving, resulting from the adoption of improved methods by the stores department, will more than cover any original expenditure by the stores department.

A third reason, therefore, why materials handling is important is that good techniques can be made to provide better service to the company, and to result in the more economical operation of other departments and the company as a whole. In a sense, a more serviceable operation means a more economical operation. Carl Renz, manager of the special services department for Southern California Gas, points out that in the materials handling operation you are your own best and only customer, and that the service rendered by the stores department is rendered only to the company of which it is a part. In line with this philosophy Southern California Gas instituted procedures that portray and control material receipts from vendors and delivery dates to requesting departments of the company so that requests are met without error and delay. This service is certainly comparable to the service rendered to the company's customers; namely, to "keep your appointment and have the know-how so you can serve easily and with understanding."

Added value

It is in the service aspect of materials handling that evidence can be seen of how value can be added to an article through the expenditure of money. The most serviceable operation is one that can add the greatest value to an article in the most economical manner. This, if anything, is the standard by which a stores department should be judged. Methods that will put the right materials in the right place at the right time are the methods which result in a good and an economical operation.

The delay in the delivery of an urgently needed valve or regulator to some place in the system, or the delivery of the wrong piece of material, can be costly in lost time. On the other hand, the prompt delivery of the right materials to a construction or repair job can set the pace for an efficient operation. The latter kind of operation involves the two-fold function of having the materials available when needed and being in a position to make prompt delivery.

Plan for coordination

To make materials available when needed requires a plan that permits the coordination of the accounting, purchasing and stores department. Out-of-stock and rush-order items are the result of a lack of coordination. Rush handling should be held to between 5% and 10%, but it has been known to increase to as high as 50% where there is a substantial lack of coordination between departments.

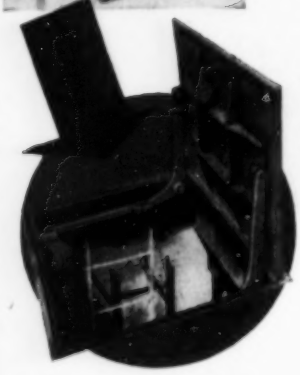
The loading of distribution company construction and maintenance trucks provides a relatively minor example of the manner in which planning by the stores department may result in a more serviceable operation. Since crew time is costly, the improved techniques are pointed at minimizing the amount of time required in loading. Although the

WACHS Safety Vault Covers

for Valve, Meter, Transformer and District Governor Vaults

Features

- One man can quickly raise cover with ease and without danger.
- Cover can not drop into vault or slam to cause injury or damage.
- Cover can be opened from the inside of the vault by one man—an added safety feature.
- Positive tamper proof lock that cannot be opened unless key is used.
- Open cover stands in upright position indicating that manhole is open.
- Unobstructed 30" square opening gives ample room for installation and servicing heavy equipment.
- Heavy duty for heavy traffic—cast iron frame and ribbed steel cover both machined for accurate fit to eliminate rattle.
- Moisture resistant, heavy cast steel levers and linkage with stainless steel pins in "Oilite" permanent oiled bronze bushings for long trouble-free service.
- Complete counterbalance structure protrudes less than 6" from the wall.

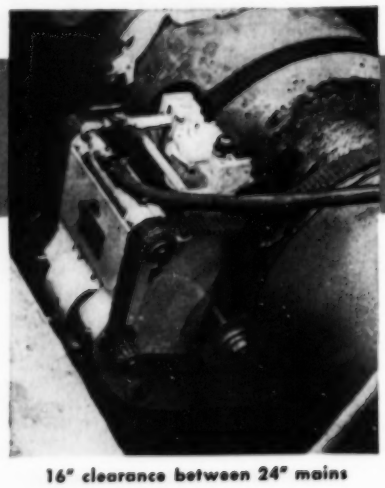


WACHS NATIONAL PIPE SAWS

Make Fast and Accurate Cuts on 10" to 48" Cast Iron and Steel Mains

Features

- Minimum Pipe Line down time.
- Cuts under water in flooded ditches.
- No broken pipe, milled cut.
- Thor Air-Powered, no flames near pipe.
- Set-up time about 15 minutes.
- Portable — weighs only 315 lbs. Two men can carry and set up unit.
- Small excavation—only 16" clearance needed.
- One machine cuts all pipe sizes from 10" to 48".
- Only two adjustments necessary for size changes.
- Cuts 24" pipe in 24 minutes — 36" pipe in 36 minutes, etc.



16" clearance between 24" mains

Write today for descriptive folder and engineering data on this new labor saving saw.

THE E. H. WACHS COMPANY

Manufacturers of Engines, Valves and Machinery since 1883

1525 NORTH DAYTON STREET · CHICAGO 22, ILLINOIS

how ONE SERVEL SALE means a Double Profit for You!

1 SERVEL, the Gas Refrigerator, is different because it's the only refrigerator that makes ice cubes without trays and puts them in a basket... all automatically! The only refrigerator with no moving parts in its freezing system... stays silent, lasts longer. Only SERVEL Gas Refrigerators offer a ten year warranty... the longest and strongest warranty you'll find. No other refrigerator in the world has these outstanding sales advantages.

2 SERVEL, the Gas Refrigerator, forges the final link for the all gas kitchen... safeguards domestic load! The amazing, profitable SERVEL is also a constant source of steady, day-in and day-out revenue throughout the year. The SERVEL Gas Refrigerator with all its outstanding features will not only maintain that gas kitchen load but will further popularize gas... the modern fuel.

no messy ice trays!

Simply pick the dry, loose, super-cold IceCircles out of the basket. The new Servel refills itself, then turns off, automatically! From automatic defrost, to the separate freezer compartment, to door shelves, to the trip-saver handle, this new Servel has every deluxe feature your customers ever wanted *plus* the refrigeration miracle of ice "cubes" without trays — automatically!

SERVEL AD DRIVE STARTS THIS MONTH!

Get complete information on how you can cash in on this great advertising and promotional drive with TV, radio, newspapers and billboards in your own local area!

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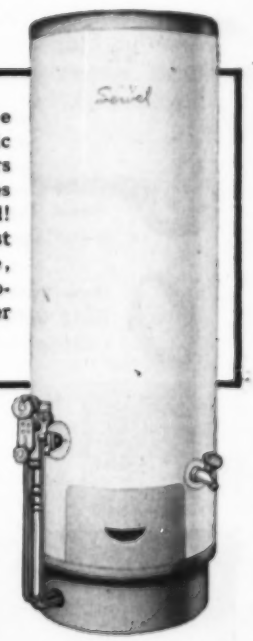
A complete line of fully automatic gas water heaters in a range of sizes to fit every need! Servel — the most dependable, trouble-free automatic water heater on the market!



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Servel

Servel Inc., Dept. 4-G, Evansville 20, Indiana • In Canada, Servel (Canada) Ltd., 548 King St. W., Toronto, Canada

specific operation varies from company to company the basic practice is for the construction and maintenance crews to place an order with the storekeeper upon their return to the warehouse at the end of the day for whatever their requirements will be for the following day. In most instances the practice is for the crews to unload scrap materials and clean their trucks at the end of the work day.

The requisitions for materials are filled by the stores department and placed on the loading dock near the truck for which it is intended before the start of the following work day. The materials are not loaded on to the truck because, for one thing, the men who use the material will be better able to locate the things they need if they load their own trucks and, in the second place, the crewmen should be expected to inventory their own materials.

At the Lone Star Gas Co.'s North Dallas storeroom the practice is to load the requisitioned materials for the next day's work into the truck at night. When the crew arrives for work in the morning it immediately takes its truck and leaves the warehouse yard.

Another hydraulic lift of SoCal. This view also shows the loading dock and equipment shelter.

Also at the North Dallas storeroom, provision is made for servicing trucks during the night. A compressed air hose along the loading dock is used for grease guns and for inflating tires. The storeroom facility is also complete with an automatic car wash rack and gasoline pumps.

Coast Counties Gas estimates that a service and construction truck loading practice in operation at its Santa Cruz operating depot has reduced by 50% the time necessary for a crew to leave the depot for a job in the morning. This represents about five minutes per crew or approximately $12.50 per day for the entire crew organization. This is an annual saving in the vicinity of $3200.

Better service

The trucking of major materials, other than construction and maintenance crews, is another instance where good practice can result in better service. It is argued by most companies that better service is provided when a company operates its own trucks. The hauling of pipe is an example that is used most frequently in behalf of this argument. Oklahoma Natural hauls 90% to 95% of all its own pipe and maintains that in so doing there is less damage done to the pipe and/or pipe wrapping. The Oklahoma company also does an estimated 75% of its own hauling.

However, if a company-operated truck operation is to be carried on economically in a manner that will provide the maximum of service to all departments of the company, it is necessary that a closely controlled dispatching operation be installed. It also means that close cooperation is required between

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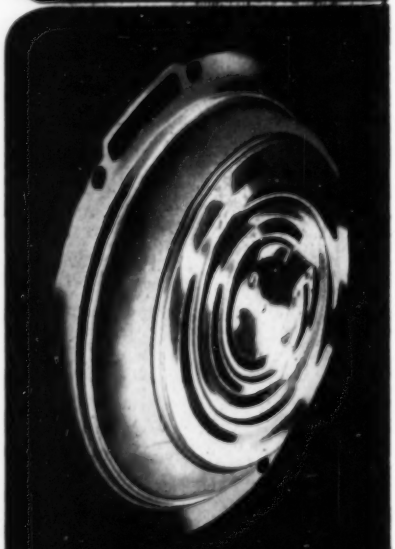

New Groove Type Metal Rim for greater rigidity and a perfect circle.

New Patented Endless Metal Tie Band for stronger clamping, more uniform depth of pocket.

New Improved Quality Rechrome Leather specially processed to Lancaster's own specifications.

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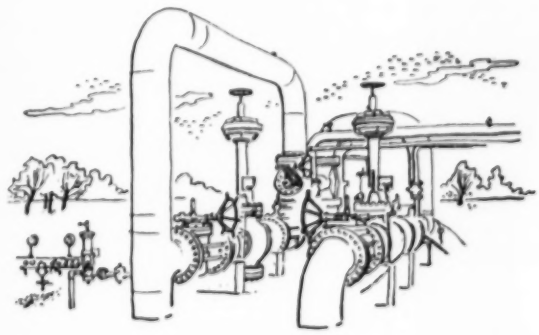
METER PARTS CO.

Laclede Gas has pioneered the growing demand for gas heat

As long ago as the "early 20's", Laclede Gas Company began pioneering gas heat in the Midwest. An extensive selling program, backed by excellent service, has consistently proven itself. Today, exceptional numbers of St. Louis families continue to convert to gas heat.

Honeywell gladly assisted Laclede in its pioneering efforts, and we're happy to note that most St. Louis families converting to gas heat have a special preference for Honeywell Controls. They're familiar with the *accurate,* trouble-free performance. And they appreciate the reliable comfort from gas heat and Honeywell Controls.

The controls shown here are typical of the fine Honeywell line. Their reputation for performance is well-known to customers requesting gas heat.



Proposed huge underground storage project

Exploration work is progressing toward the development of underground storage facilities near Laclede's Service Area. When completed, it will enable Laclede to serve a large additional number of house-heating customers.

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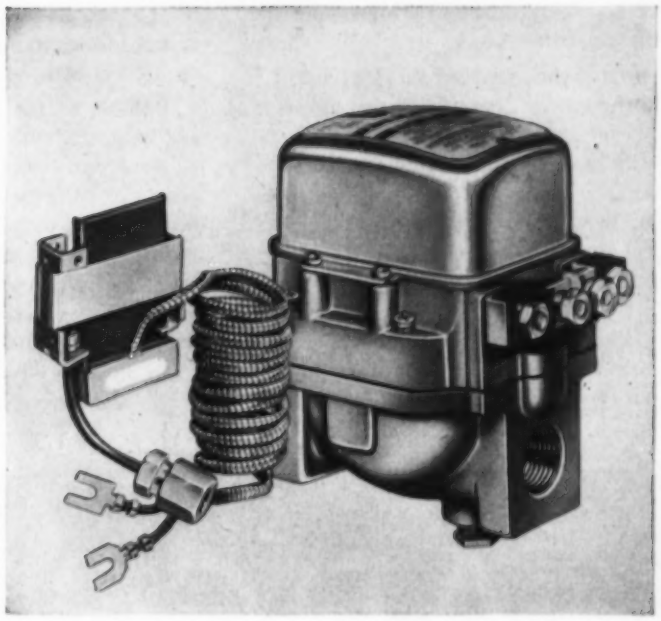

New Y-400 Powerpile Packages—*completely new, self-powered* control system . . . blue flame pilot uses no primary air . . . gives 40% more power with half as much gas. Automatic, semi-automatic, and manual thermostats are available for this system.

Protectorelay (Type R890)—designed especially to give complete protection of flame rectification . . . the speed and sensitivity of electronics . . . and top performance in the desired sequence.

Electronic Weathercaster—a key element in the famous Moduflow system is located *outside* the house. It senses weather changes, and *automatically* signals the electronic control system indoors.

112 offices across the nation

the transportation department and the stores department.

It is in the matter of service rendered by the stores department that there is a clear cut requirement for management level considerations. There have recently been varying degrees of reorganization in several companies. The principal changes have been in the alignment of responsibility in a manager who can coordinate the various activities of the stores department. It is necessary that the manager or one in control of the department see the overall picture in such a manner that he can point out the specific goals that are to be attained.

Because of the rapid growth of the industry, the stores department has often come under the control of persons not sufficiently familiar with the whole operation, and as a result there has been some confusion and inconsistency in the operation. In any modern operation the materials storing and handling department must be considered in its functional capacity as a part of the whole company. The one in control must be well enough acquainted with the whole operation to supervise the operation with this kind of picture in mind.

Nothing has retarded the growth of the materials activity in the gas industry more than the absence of this philosophy. Industry as a whole was quick to realize the benefits to be had from good techniques in materials handling because of the competitive nature of their business. The gas industry was slow because it was occupied with problems of extreme growth. Now that the industry has had an opportunity to stop and take a little longer look at its operation, however, it is finding that a materials handling operation that is integrated with the overall operation and modernized along with other parts of the organization is essential.

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Safety in good handling

Finally, good practices in materials handling and storing lead to a safer operation. This is a fourth reason why careful consideration of handling procedures is important.

Here, again, the problem boils down to one of how to carry on the most economical overall operation. It is no secret that accidents are expensive in loss of time as well as in cash outlay for insurance and benefit payments. Good handling and storing methods, even if they involve the expenditure of money for equipment, will result in a safer and more economical operation.

A case in point to indicate the importance of giving proper consideration to the safety of handling is the experience of the Peoples Gas with mechanized equipment. Before conversion to modern mechanized equipment they had an average of one back injury a month in their stores department. With modern handling equipment and techniques they now have about one back injury every three years.

According to the National Safety Council, one-quarter of all disabling industrial accidents occur during the handling of materials. During 1951 there were 61.6 million man-days lost because of accidents in materials handling. This figure represents a total of $583 million. In view of the fact that it is a dangerous undertaking to move and transport heavy, bulky materials

with heavy equipment, this is hardly to be considered a surprising figure.

That aspect of materials handling that has to do with safety may be considered from three points of view. In the first place, of course, there is the matter of safety of personnel involved directly in the handling operation. Secondly, there is the matter of safety of the materials being handled, and the safety of the personnel using the materials handling equipment.

Although modern mechanized materials handling equipment will reduce the possibility of accident, it also poses new problems for safety. New vehicles, higher piling of materials, and other safety problems can result from the improper use of materials handling equipment.

The matter of good housekeeping, which might appear to be of a minor nature, in the stores operation, might well be considered important in terms of safety. The Texas Gas Transmission Corp., with three major warehouses and sub-stores at various locations along its line, has a record of only three lost-time accidents in the past three years. This includes a total of 120,558 man-hours. A program of good housekeeping in the stores department is attributed with producing such a record.

This, therefore, is the importance of the materials handling activity in the industry. Those in the industry who are close to the operation are well aware of this importance, and are continually searching for new methods and techniques that will make the handling of materials both a more serviceable and a more economical undertaking. Although improvements have, in most instances, been in isolated cases there is gradually being built up a body of experience which is applicable to the industry.

Editor's Note: This article, as the first of an occasional series on materials handling and storing in the gas industry, undertakes an overall picture of the activity. It shows something of the extent and size of the activity, points out the importance of good practice and shows instances where the application of improved procedures has led to better service and a more economical operation.

Ensuing articles will delve into specific handling and storing practices. They will show how the gas industry's particular problems can be met and solved through the use of modern storeroom equipment and techniques.

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SUMMARY OF ANNUAL ESTIMATES OF NATURAL GAS RESERVES FOR PERIOD DEC. 31, 1945 TO DEC. 31, 1953

(Millions of Cubic Feet—14.65 Psia, at 60° F)

Year	Natural Gas Added During Year: Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total of Discoveries, Revisions and Extensions	Net Change in Storage	Net Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
1945	—	—	—	—	—	147,789,366	—
1946	a	a	17,729,152	a	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	a	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426
1949	8,061,429	4,612,870	12,674,299	82,746	6,245,041	180,381,344	6,512,004
1950	9,172,381	2,877,351	12,049,732	54,301	6,892,678	185,592,699	5,211,355
1951	13,013,606	3,039,385	16,052,991	132,751	7,966,941	193,811,500	8,218,801
1952	8,934,470	5,411,043	14,345,513	198,850	8,639,638	199,716,225	5,904,725
1953	13,371,355	7,081,661	20,453,016	516,431b	9,238,540	211,447,132	11,730,907

a Not estimated.
b All native gas in storage reservoirs formerly classified as a natural gas reserve is included in this figure.

Reserves reach another new high

PROVED recoverable reserves stood at another new high as of last Dec. 31, surpassing 200 trillion cu ft for the first time since the AGA-API reserves committee began making its final surveys. Furthermore, the year's increase of 11.7 trillion (which brought the total to 211.4 trillion) was the largest ever recorded, despite an all-time high mark in production of 9.2 trillion, which is an increase of 600 billion over 1952.

The joint report, issued late last month, reflected the discovery of 7.1 trillion ft of new reserves in 1953 as compared with 5.4 trillion ft in new fields brought in during 1952, emphasizing the important increase in exploration activities resulting from the ever-increasing demand for natural gas. Further exploration and drilling in existing fields added another 13.4 trillion. Nearly 516 billion ft were added to estimated underground storage reserves.

Liquid hydrocarbons also shot up during the year. Natural gas liquids rose to a record 5.4 billion barrels, up 400 million despite a 303-million production figure. Crude oil topped 28.9 billion, compared with 1952's 28 billion.

Most significant gains centered around three of the states in the "Four Corners" area where the San Juan basin lies. New Mexico led all states under the heading "extensions and revisions" and was third in the "new fields and new pools" category. In extensions and revisions, Utah trebled its previous reserves, while Colorado recorded close to a 50% gain.

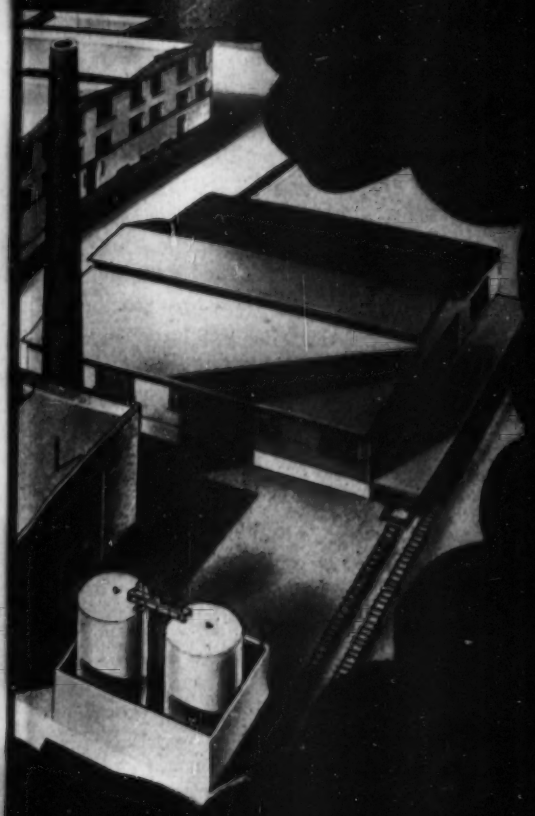
ESTIMATED PROVED RECOVERABLE RESERVES OF NATURAL GAS IN THE UNITED STATES

(Millions of Cubic Feet—14.65 Psia, at 60° F)

	Changes in Reserves During 1953: Reserves[2] as of Dec. 31, 1952 (1)	Extensions and Revisions[2] (2)	Discoveries of New Fields and New Pools in Old Fields[2] (3)	Net Change in Underground Storage[3] (4)	Net Production[4] (5)	Reserves[2] as of Dec. 31, 1953: Total all but (5) (6)	Non-Associated[5] (7)	Associated[6] (8)	Dissolved[7] (9)	Underground Storage[8] (10)
Arkansas	984,582	252,566	10,983	2,588	39,453	1,211,266	758,404	162,085	285,563	5,214
California[9]	9,340,022	219,205	50,348	50,717	500,945	9,159,347	2,352,644	2,137,871	4,605,198	63,634
Colorado	1,164,249	542,852	213,313	0	56,139	1,864,275	1,191,520	57,810	614,945	0
Illinois	211,651	48,856	929	0	30,185	231,251	10,001	2,500	218,750	0
Indiana	36,714	215	2,150	3,901	7,150	35,830	3,152	2,700	23,240	6,738
Kansas	14,193,565	466,236	1,587,106	8,457	467,762	15,787,602	15,287,581	139,158	319,669	41,194
Kentucky	1,313,523	42,014	11,160	5,836	71,000	1,301,533	1,226,061	0	56,072	19,400
Louisiana[9]	31,451,614	3,144,349	1,294,440	0	1,431,491	34,458,912	27,505,549	4,508,051	2,445,312	0
Michigan	254,543	(—)183,567	250	110,964	6,671	275,519	34,629	0	46,780	194,110
Mississippi	2,364,060	248,669	156,372	196	200,116	2,569,181	1,947,388	390,302	230,838	653
Montana	827,603	(—)50,924	925	19,493	33,097	764,000	616,312	34,375	84,206	29,107
Nebraska	93,958	87,954	12,300	0	12,102	182,110	148,696	6,646	26,768	0
New Mexico	14,038,889	3,539,961	301,459	78,003	436,102	17,522,210	14,075,903	1,754,422	1,594,172	97,713
New York	68,640	(—) 2,688	0	7,414	2,362	71,004	42,452	0	468	28,084
Ohio	731,483	(—)36,247	5,618	86,408	31,280	755,982	497,645	0	33,453	224,884
Oklahoma	11,764,829	875,175	427,602	26,238	865,471	12,228,373	6,882,492	1,782,641	3,488,472	74,768
Pennsylvania	709,585	9,442	75,450	55,673	98,306	751,844	501,751	0	37,171	212,922
Texas[9]	105,732,763	2,591,789	2,868,008	5,466	4,668,400	106,529,626	69,324,826	20,661,008	16,536,493	7,299
Utah	283,412	826,517	12,820	0	9,691	1,113,058	1,108,297	0	4,761	0
West Virginia	1,660,070	88,247	21,850	49,775	166,000	1,653,942	1,428,425	0	59,503	166,014
Wyoming	2,321,124	481,122	23,795	5,302	91,712	2,739,631	1,840,794	349,154	531,695	17,988
Miscellaneous[1]	169,346	79,612	4,783	0	13,105	240,636	65,878	0	174,758	0
Total	199,716,225	13,371,355	7,081,661	516,431	9,238,540	211,447,132	146,850,400	31,988,723	31,418,287	1,189,722

1 Includes Alabama, Florida, Maryland, Missouri, North Dakota, and Virginia.
2 Excludes gas loss due to natural gas liquids recovery.
3 The net difference between gas stored in and gas withdrawn from underground storage reservoirs, inclusive of adjustments and native gas transferred from other reserve categories.
4 Net production equals gross withdrawals less gas injected into producing reservoirs. Changes in underground storage and gas loss due to natural gas liquids recovery are excluded. December production estimated in some instances.
5 Non-associated gas is free gas not in contact with crude oil in the reservoirs.
6 Associated gas is free gas in contact with crude oil in the reservoirs.
7 Dissolved gas is gas in solution with crude oil in the reservoirs.
8 Gas held in underground reservoirs (including native and net injected gas) for storage purposes.
9 Includes off-shore reserves.

AND FIELD STOCKS



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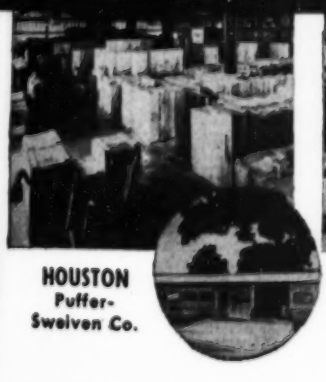

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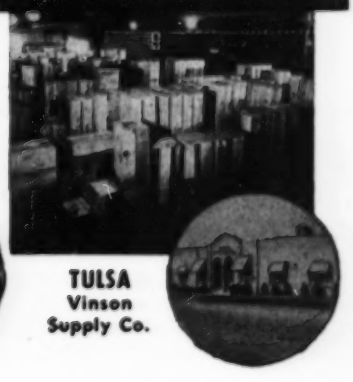

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Tough Digging in Close Quarters

IN PORTLAND, MAINE, the soil in many places can be downright troublesome, with large stones and boulders mixed in with smaller stones and gravel, a combination that makes tough digging. Add to this the fact that trench lines in many places run right alongside rows of trees, poles and other obstructions and you've got a really mean job of trenching.

Yet this CLEVELAND Model 95 "Baby Digger" is moving right along on the job—as shown by the discharge from the conveyor—coming through with the same dependable performance that has made it an outstanding favorite for over 30 years.

This is the kind of job where CLEVELAND'S famous multi-speed transmission really pays off, enabling the operator to select the *right* combination of power and speed for the particular job condition from more than 30 available combinations of digging wheel and crawler speeds.

The "Baby Digger's" compactness and maneuverability also played important parts in completing this job right on schedule in spite of numerous obstructions. The large boulders deposited to the left of the trench in the photo show that good use was also made of CLEVELAND'S reversible conveyor on this job.

Write for descriptive bulletins and specifications, or get the full story on CLEVELANDS from your local distributor.

THE CLEVELAND TRENCHER CO.
"Pioneer of the Modern Trencher"
20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

The PAR program—big year ahead

By E. H. EACKER, President
Boston Consolidated Gas Co.

THE AGA board of directors has approved for 1954 a PAR Program providing $2,460,000 for total gas utility activities. An additional $230,000 for gas pipeline research raises the figure to a total PAR quota of $2,690,000 for gas industry promotion, advertising and research leadership this year. The entire PAR Program has been closely tied in with the Gas Industry Development Program.

Basic PAR activities

Five basic promotional activities are conducted by your national association under PAR. These include: (1) representing member companies at the national level; (2) mass national preselling of gas and gas appliances; (3) coordinating all gas industry promotion and sales efforts; (4) working with utilities at the local level, and (5) making long-range preparations for the future.

Five promotional field men were assigned last year to visit utilities in all regions of the country. They have been markedly successful in acquainting member companies with the scope and benefits of AGA national promotion and advertising programs. As a result of their visits, many companies have been encouraged to participate in AGA activities for the first time.

Potentially one of the most promising gas industry activities is the Mrs. America contest, which is being cosponsored nationally by AGA for the first time. Gas companies in Boston and many other areas of the country are using radio, television and other mass communication media to tie in locally with this national promotion.

At the same time, efforts of a PAR-financed educational service bureau are helping to familiarize future homemakers with gas and modern gas appliances. A special kit for the schools, en-

GAS digests

In addition to his duties with Boston Consolidated, Mr. Eacker is the current president of the American Gas Association.

titled "Natural Gas — Science Behind Your Burner," has been distributed to more than 8000 science teachers throughout the country. Additional materials prepared by leading educators are being reviewed by the National Science Teachers Association to assure their educational value.

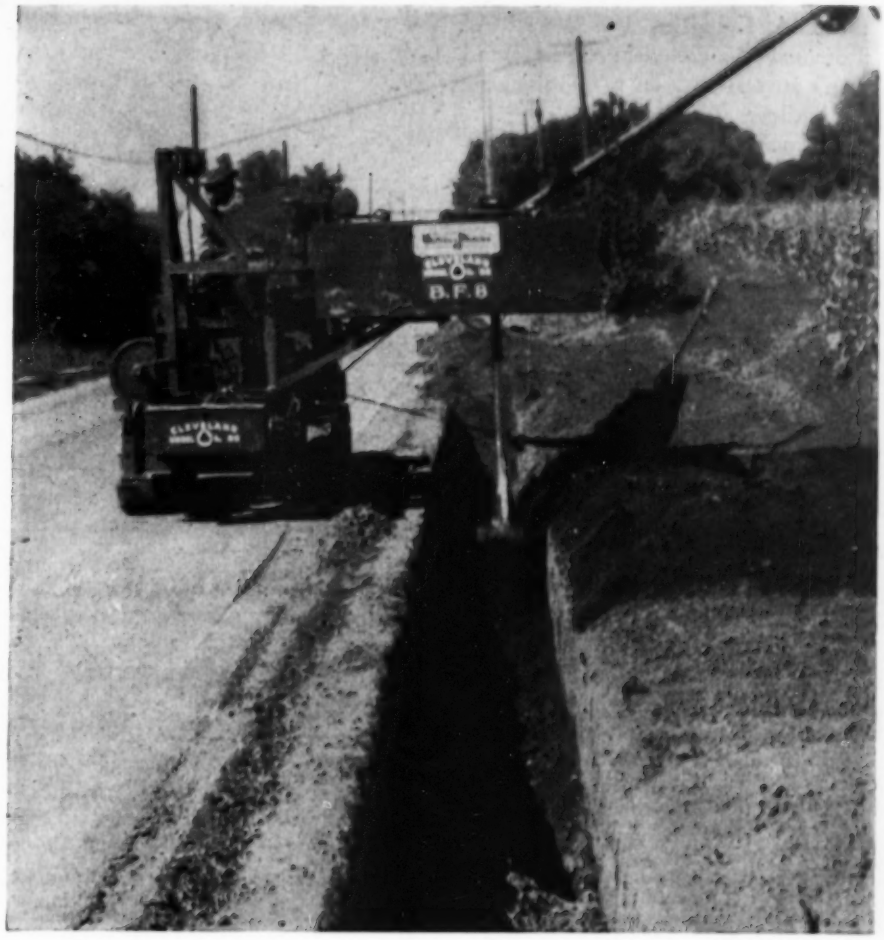
Several years ago AGA made a broad survey of utility members to define the appliance selling seasons. Information gleaned from this study enabled the association to publish last fall a year-round sales plan book for the gas industry. This major achievement means that this year the gas industry's 10 basic campaigns and sales promotion periods are being fully coordinated at both the national and local levels earlier than ever before. This is but one more indication of the gas industry's new "Accent on Action."

Field test program

The gas industry now has available for immediate development completely automatic ranges featuring new and field-tested electric and gas single-point ignition devices. This is the direct result of the completion of a 34-month PAR-sponsored field test program of automatic range ignition. It is another outstanding achievement in our long-range promotional offensive.

One very recent achievement of the AGA New Freedom Gas Kitchen Bureau is of special interest to your sales and builder-contact staffs. This year, for the first time, the official kitchen and laundry film of the National Association of Home Builders will feature New Freedom Gas Kit-

This article is an abstract of a talk presented at the annual meeting of the NEGA held last month in Boston.



Keeps 4 Backfillers Busy

IN OMAHA, NEBRASKA, the Metropolitan Utilities District keeps 4 CLEVELAND Backfillers busy on construction jobs for gas, sewer and water lines.

The photograph shows how easily the Model 80 Backfiller is operated by only one man. It also shows how the 80, traveling parallel to the trench as it works, holds to an absolute minimum any interference with the highway's normal traffic capacity.

The 80 is not only cleanly filling this good sized trench, it is also compacting it simultaneously with its tamper unit, a standard accessory feature of this versatile machine. The results it is obtaining clearly illustrate its ability to backfill fast and efficiently and at the same time do an outstanding job of compacting the fill. Traveling continuously as it performs both these operations, it conserves on manpower and eliminates the need for attendant equipment.

In addition to backfilling and compaction these Model 80's do side crane work of all kinds, such as the handling and installation of cast iron, steel and concrete pipe, valves, etc.

The repeated purchases of these machines by this municipal utilities body are evidence of the Model 80's ability to deliver consistently satisfactory results through consistent, outstanding performance on a wide variety of job types and sizes.

Write for descriptive literature and specifications, or get the full story on CLEVELANDS from your local distributor.

THE CLEVELAND TRENCHER CO.

"Pioneer of the Modern Trencher"

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

chens and Laundries. The film will be promoted on a national scale and offers many attractive tie-in possibilities for local utilities.

National advertising, closely coordinated with PAR national promotions, will be increased from $926,000 in 1953 to $1,018,000 this year. Approximately 177,400,000 selling messages for gas and automatic gas appliances will appear in 34 consumer, architect-builder, industrial and commercial magazines. These publications have a guaranteed circulation of more than two and one-half million readers in New England alone.

Industrial gas

The industrial gas field is also receiving increased attention under the PAR Program. Industrial gasmen have recommended that a plank be added to the Gas Industry Development Program encouraging gas companies, within the limitations of their systems and at rates commensurate with the cost of the service, to provide industrial gas on a *firm* rather than an interruptible basis.

In addition, a new industrial and

commercial gas educational committee has been formed to promote knowledge of the use of gas and gas equipment in colleges, universities, and technical schools.

Ninety completed projects

During the first nine years of the PAR Program, the gas industry has benefited from 90 completed research projects. A total of $1,267,000 has been projected by PAR to carry on research for utilities and pipelines in 1954. Greater emphasis than ever before will be placed on long range fundamental research studies.

Heading the list of 44 projects is the recent range unit demonstration (See GAS, February, page 57.) Typical studies are those to develop substitute and replacement gases, and a project to develop gas incinerator improvements that will increase performance and acceptance of this glamorous new load building appliance.

Filling summer peaks

You are well acquainted with the importance of filling summer peaks to balance the winter load. To fill the summer peaks in order to balance the winter load, a PAR research investigation has been launched on potential methods of cooling, using gas as the fuel.

A nationwide survey of gas all-year air conditioning owners by the AGA home service committee is just getting under way.

Consequently, the gas industry is now in a strategic position to develop educational, advertising and promotional programs to acquaint other women with the advantages of gas all-year air conditioning for the home.

Manufactured under Consolidated Edison Co. of N. Y., Inc. Patent No. 2,342,045. Application development assistance by Public Service Electric and Gas Company of New Jersey

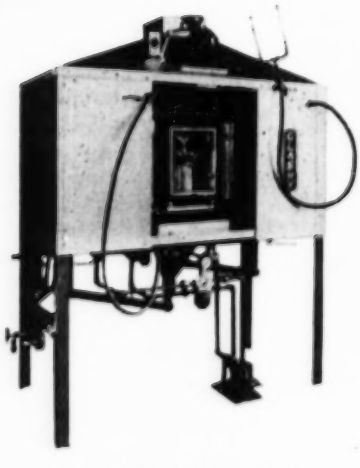
J. P. GLASBY MFG. CO., Inc.
Belleville 9, N. J.
Manufacturers of Glasby Conversion Burners and Furnaces

PRECISION REPAIRS ON MACHINES CUT TIME AND EFFECT SAVINGS!

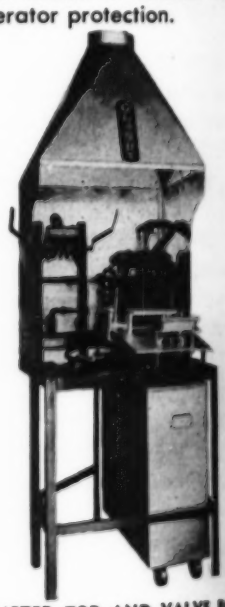
Leading utilities now rely on

GLASBY METER REPAIR MACHINES

and reduce repair time to a minimum. Front and Back Machine and Top and Valve Box Machine both available in 5 and 10 light meter capacity and adjustable to most makes of meters. They feature approved safety devices for operator protection.



METER FRONT AND BACK REMOVING MACHINE



METER TOP AND VALVE BOX COVER REMOVING MACHINE

ASSOCIATIONS

Gasmen head for Canada for distribution meeting

P. W. Geldard
Consumers Gas

Robb Quinby
Con Ed

About 1100 representatives of gas companies in the U. S. and Canada are expected to gather at the Mount Royal hotel, Montreal, April 20-23 to attend the four-day conference on distribution, motor vehicles, and corrosion presented by the operating section of the American Gas Association.

P. W. Geldard, Consumers Gas Co., Toronto, will welcome delegates at the opening session on Tuesday, April 20, in his capacity as chairman of the AGA distribution committee.

Robb Quinby, Brooklyn Union Gas Co., will discuss financial needs of the gas industry during this first session and James Webb, Consolidated Edison Co., will offer a new approach to meter design, with an open discussion on metering.

Dual luncheon conferences will follow with K. W. Person, Minneapolis Gas Co., presiding at the meeting devoted to construction and maintenance and J. M. Chrisman, East Ohio Gas Co., chairmanning the conference on meters and metering. Tuesday afternoon will see the first of five sessions devoted to automotive and mobile equipment. Two members of the Quebec Hydro-Electric Commission will lead the discussion.

Wednesday's general session, headed by H. M. Blain, New Orleans Public Service, will be devoted to the new code for pressure piping, distribution system maintenance, mechanization of meter shop operations, and odorization. A concurrent session on automotive equipment will feature a symposium on applied hydraulics. Corrosion will high-

H. M. Blain
New Orleans

James Webb
Con Ed

"YES! We made HEATH Leakage Control Surveys of some 500 gas properties during 1953."

"YES! ... they were more than pleased with the results ... especially with the reports as to *accuracy* of leak locations and the *classification* as to size and importance."

"YES! ... that neighboring Gas Company was one of the 500 and we certainly appreciate their telling you about our work and recommending us so highly."

"YES! ... they agree that nothing but the *best* will do when it comes to AUDITING your Gas Leakage conditions."

"YES! ... I certainly advise you to use our Over-All Heath Leakage Control Survey ... especially if, up to date, you may have been using only *one phase* of our complete Survey Service."

You too can save thousands of dollars worth of gas annually ... reduce insurance problems by reducing hazards ... improve public relations and safety conditions. Decide *today* to have a Heath Leakage Control Survey on your property!

You Can't Sell Gas that Leaked Out!

HEATH

Leakage Control Surveys

Write, Wire, or Phone for Complete Information

HEATH SURVEY CONSULTANTS, INC.

572 Washington Street, Wellesley 81, Massachusetts

Midwestern Office — Richmond, Michigan

light a third Wednesday session, when controls and protective measures will be discussed. This will carry over into a luncheon conference.

Additional luncheon meetings will be devoted to customer service and distribution design and development. Wednesday's automotive and mobile equipment session will feature a talk by Fred N. Clarke, commission of motor vehicles for the state of New Hampshire, on vehicular law enforcement.

Corrosion, construction and maintenance, and meters and metering will occupy luncheon conferences on Thursday. The fourth automotive meeting wil be held that afternoon.

Some distribution problems of utilities will be presented and discussed at the final general session on Friday, and final meetings will be held on automotive equipment, customer service, and distribution design and development. Running concurrently with the distribution luncheon conference Friday will be a panel meeting devoted to plastic piping, headed by Guy Corfield, Southern California Gas Co.

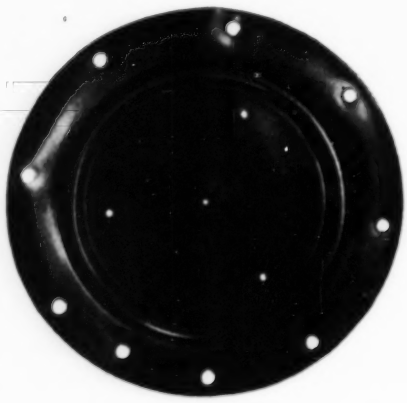
Basic plans laid for 36th AGA convention

Basic plans for the program of the 36th annual convention of the American Gas Association were outlined at a recent meeting of the general convention committee under the direction of Chairman Everett J. Boothby, president of Washington (D. C.) Gas Light Co. Among subjects presented for final selection by the committee for the general sessions are: regulation, legislation, natural gas future prospects, supervisory training, increasing costs of natural gas, and possibly a panel discussion on pertinent topics.

Headquarter hotels for the Oct. 11-13 convention in Atlantic City include the Chalfonte-Haddon Hall hotels, general management and accounting sections; Shelburne, industrial and commercial section; Dennis hotel, residential gas; Claridge hotel, operating section.

If It's a Molded Diaphragm ...We Can Make It

HAARTZ-MASON brings thirty years of experience in quality coated fabrics to the gas industry. The Mechanical Products Division is completely equipped to supply the requirements of the gas industry with precision molded diaphragms and quality coated fabrics.



Write for our new catalog "Industrial Coated Fabrics." We are prepared to quote against customer's blueprints on all types of molded diaphragms.

For the finest pressure regulation and most sensitive control specify Haartz-Mason diaphragms.

Your inquiry is solicited.

HAARTZ-MASON, INC.
MECHANICAL PRODUCTS DIVISION
Watertown 72, Massachusetts

HAARTZ-MASON, INC., Watertown 72, Massachusetts

Gentlemen: Please send catalog covering all types of diaphragms for the gas industry.

TO.....

STREET..... ZONE.....

STATE.....

Roundtable discussions to highlight sales meeting

To provide an interchange of ideas and methods in the promotion and sales of gas appliances, a series of round table discussions will be held each afternoon during the eastern natural gas regional sales conference scheduled for the William Penn hotel in Pittsburgh, April 19-20.

First-day panels will be devoted to all-year air conditioning, gas househeating, gas incineration, and water heating, in addition to discussions on selling through the dealers and advertising as a key to sales.

Christy Payne Jr., Peoples Natural Gas Co., will present one of the first reports on the results achieved by one of the 10 test cities selected to operate the Gas Industry Development Program. Top sales executives of the Manufacturers Light & Heat Co. and Equitable Gas Co., both of Pittsburgh, will tell the "Pittsburgh Story," relating present plans and progress of the joint sales promotion plan of three gas utilities.

Home Service and Sales, the "matchless" range program, and gas clothes dryers will close out the scheduled panel sessions.

SGA expects 46th annual to be biggest in history

The 46th annual convention of the Southern Gas Association, to be held April 26-28 in Houston, is expected to be the biggest in history, with attendance of approximately 2000 delegates anticipated.

General session speakers will include Dr. Watrous H. Irons, president of the Federal Reserve Bank of Dallas, and E. H. Eacker, president of the AGA. Dr. Arthur Secord, director of community services of Brooklyn College, is also scheduled to deliver a talk.

Headquarters hotels will be the Shamrock and the Rice: convention sessions on April 26 and 27 will be at the Rice hotel while general session and luncheon on April 28 will be at the Shamrock.

Some luncheon speakers and their subjects include: J. E. Hodges, Hughes Tool Co., "The Economic Outlook for 1954-55; The Dione Lucas Show (at the home service

H. K. Griffin
SGA President

Curtis Smith
Chairman

luncheon); Gordon C. Griswold, Brooklyn Union, "New Economic Implications for the Natural Gas Industry."

Section meetings and subject matter will include: Accounting—"What Makes a Good Annual Report," by Tom H. Wheat, Transcontinental Gas; "Accounting Statements and Reports in Rate Cases," by F. W. Peters, Oklahoma Natural; "Fair Value in Rate Making," by Jackson C. Hinds.

Distribution: A. P. Rowland of Lone Star will tell how gas service was restored after the Waco tornado; H. N. Oldham, Southern Union, Southern Standard Building Code.

Employee Relations: "Have You Tried Listening?" by Dr. Wesley Wiksell, Louisiana State University; "You Never Had It So Good," by Walter M. Casey; "Management Development — Panacea or Poppycock?" by M. V. Cousins, United Gas.

Transmission: "Atomic Power for Industry," by R. B. Briggs, Oakridge National Laboratory; and SGA pulsation research project report, by E. N. Henderson, Arkansas Louisiana Gas. This section will also have an information panel on transmission.

Buyers meeting to feature open discussion periods

The national purchasing and stores conference, scheduled for the Henry Grady hotel in Atlanta on April 19-21, will feature not only outstanding speakers, but opportunities for full discussion of any question will follow each presentation.

E. G. Plowman, vice president and general traffic manager of the United Steel Corp., will discuss traffic, with special emphasis on routing, rates, handling, and claims. "Working Together" will be the subject presented by J. S. Phillips, vice president and general manager of United Fuel Gas Corp. R. H. Bussard, Washington Gas Light Co., and A. H. Cannon, Transcontinental Gas Pipe Line Co., will discuss "Inventory Control" from the viewpoint of a distribution and transmission company, respectively.

Important subcommittee reports will highlight the three-day meeting. Lester R. Michelsen, Peoples Gas Light & Coke, chairman of the standard packing subcommittee, will report on standard packaging for steel pipe couplings and stop cocks. Latest information on methods of inventory taking, ways to reduce purchasing and stores costs, new de-

More for your money!
DAVEY ··· TODAY'S BEST COMPRESSOR AND TOOL INVESTMENTS!
Davey Model 210 Super Chief
From the standpoint of original investment — and reduced operating costs — you get more for your money with Daveys.
DAVEY MULTI-PORT VALVES require less engine power and less fuel . . . never carbon or foul . . . assure constant full volume of air, keep tools operating at top efficiency. And, they're only one of many features of today's fine Davey lightweight, heavy-duty compressors in 60-125-160-210-315-500-600 c.f.m. sizes.
DAVEY AIR TOOLS are designed to meet today's needs! They're streamlined . . . perfectly balanced . . . easier to handle . . . hard-hitting with extra high penetrating power. And, because they offer maximum parts interchangeability, they greatly reduce maintenance and repair expense.
For complete details, see your nearest Davey distributor!
Davey Backfill Tampers, 35 and 45 lb. sizes
Davey Rock Drills, 4 sizes 28 to 58 lbs.
Davey Paving Breakers 4 sizes—35 to 90 lbs.
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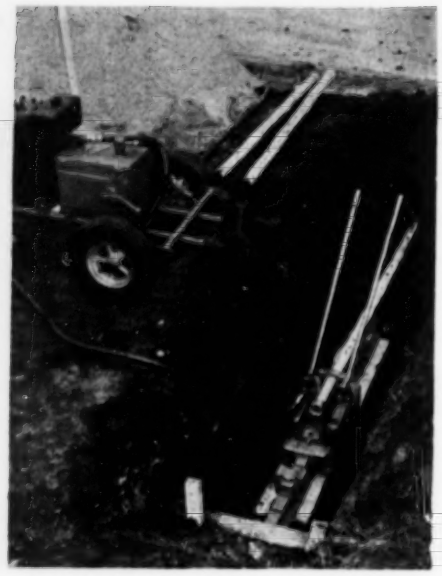
DAVEY
pioneers of air-cooled air
DAVEY COMPRESSOR CO.
KENT, OHIO

FAST, EASY WAY

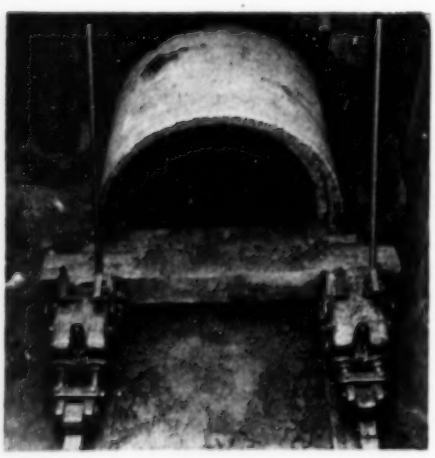
TO INSTALL PIPE...

AT LOWER COST



PUSH PIPE UNDERGROUND WITH A GREENLEE HYDRAULIC PUSHER

Here's the simple, cost-cutting way to install underground pipe. Speed your jobs with a GREENLEE Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, backfilling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes — model shown above for pushing 3/4" to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump (as shown above) also available for extra ease and speed of operation.



GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 1944 Columbia Ave., Rockford, Ill., U.S.A.

Newly elected officers of the Mid-West Gas Association are (left to right): M. B. Cunningham, Iowa Power & Light Co., president; M. K. Wrench, Metropolitan Utilities District of Omaha, 1st vice president; George B. Johnson, Minneapolis Gas Co., 2nd vice president; and Harold E. Peckham, Northern States Power Co., reelected secretary-treasurer.

velopments in equipment and methods for material handling, storeroom design, standardization, general vs special buying are among subcommittee reports to be presented.

A report will be made on recruiting, selection, and training of purchasing and stores employees. Carl H. zur Nieden, Philadelphia Electric, will report on the first six months' operation of the "problems" subcommittee, which is prepared to aid any gas company needing assistance on purchasing and stores problems.

Gas measurement course offers variety of subjects

George T. Naff, president of Texas Eastern Transmission Corp., will present the principal address at the Southwestern Gas Measurement short course, scheduled for Norman, Okla., April 13-15. Pat H. Miller, Texas Eastern Transmission Corp., is chairman of the general committee of the short course.

The program as outlined by K. R. Tibbets, Warren Petroleum Corp. and chairman of the program subcommittee, will be devoted to the most part to classroom sessions. Approximately 100 instructors have been selected to teach a wide range of subjects all of which are related either directly or indirectly to gas measurement and regulation.

This will be the 29th short course, which is sponsored by the college of engineering at the University of Oklahoma.

Industrial relations men to gather in Chicago

For the first time in 17 years, the AGA sales conference on industrial and commercial gas will be held in Chicago. The Edgewater Beach hotel is headquarters for the April 12-14 meeting.

Monday, April 12, has been designated Industrial Gas Day. The general session will be held on Tuesday, together with the tradi-

Executive committee members of the Southwestern Gas Measurement short course met recently to complete plans for the April 13-15 session. They are (seated, l to r): E. C. McAninch, Oklahoma Natural; R. M. Scofield, Lone Star Gas; W. H. Carson, University of Oklahoma; C. E. Terrell, Southern Natural. Standing: W. H. Woods, Runnels Gas Products Corp.; James L. Griffin, Northern Natural; Ben F. Worley, United Gas Corp.; T. S. Whitis, Amarillo Oil; and Paul H. Miller, Texas Eastern Transmission.

READ WHAT THEY SAY ABOUT *Tri-Line* CONCRETE CUTTERS

"For the past three seasons we have used your Tri-Line Cutter for sawing contraction joints in concrete pavements in highway and airport construction . . . The Tri-Line Cutter has proved to be a sturdy dependable machine, particularly adapted to cutting long runs of longitudinal contraction joint."

KOSS CONSTRUCTION CO.
Des Moines, Iowa

"We have been using a Tri-Line Saw for almost one year and we are thoroughly satisfied with its performance. We use it extensively in cutting for machine foundations, utility lines and general concrete floor repairs. This practice has proved very successful . . ."

WOLVERINE TUBE DIVISION
Calumet & Hecla Consolidated
Cooper Company Incorporated
Decatur, Alabama

ASK FOR FREE DEMONSTRATION... PROVE *Tri-Line* BEST BY ACTUAL TEST

Contractors, street and highway department officials, public utilities, and others concerned with the construction and maintenance of concrete pavement are discovering new savings in labor and materials by sawing with Tri-Line Concrete Cutters. They are amazed at the ease of handling, the speed of cutting — pleased with the full 30 gallon water supply and the three-wheel (non-tilting) undercarriage that assures longer blade life and lower cutting costs — convinced by the many engineered features which prove Tri-Line is "Best by Test". Prove it to yourself — we will be pleased to arrange a Tri-Line demonstration on any job without obligation.

Write for **FREE** Illustrated Brochure

Complete specifications, construction details, and the name of your nearest Tri-Line Dealer will be sent upon request.

TRI-LINE COMPANY
Dept. 971 Racine, Wisconsin
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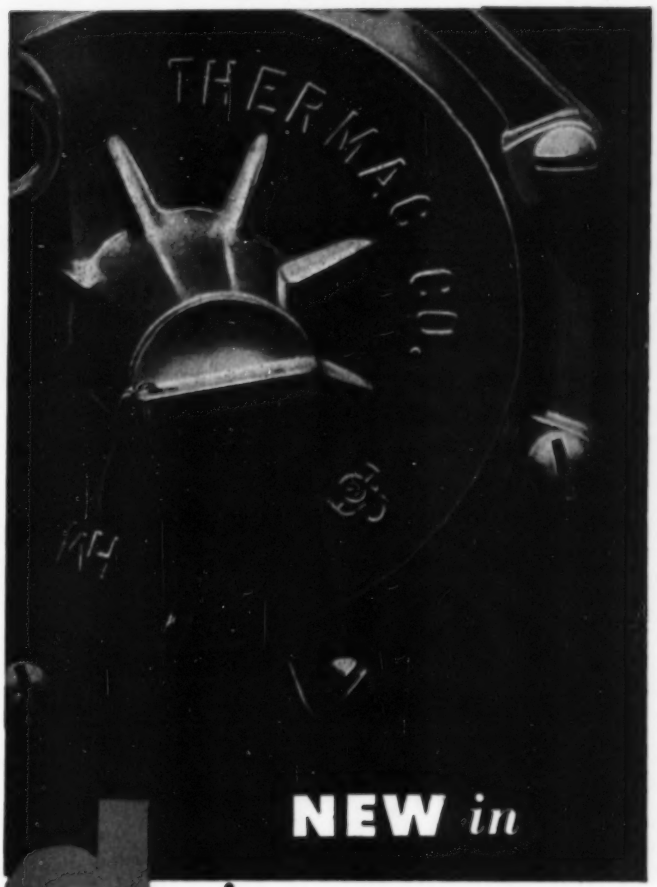
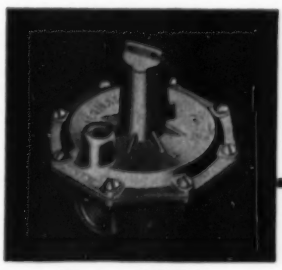


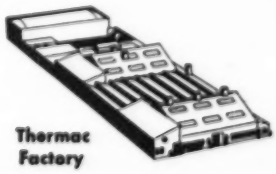
NEW *in* design- PERFORMANCE

Leadership in the industry demands that we constantly improve both our product and service. The new Thermac 8-sided Appliance Regulator achieves relatively larger effective diaphragm area with resultant higher capacities with relation to its outside dimensions. Greater sealing against diaphragm leakage, easier to install in tight spots, plus provision for vise grip are new special features.

Here in the new "T" Series you have a smaller regulator with more capacity at a lower price and of the highest quality obtainable. Send for our new catalog giving complete data.



Thermac "T" Series Appliance Regulator



Thermac Factory

SEND FOR NEW RATINGS

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800 East 108th Street
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THE NORMAC BELL JOINT CLAMP

A SIMPLE SOLUTION for one of the GAS INDUSTRY'S *most trying problems*

Solves Your Joint Repair Problems • Quick • Easy • Permanent

Installed in small pavement openings. Available in all standard sizes from 3" to 12". A simple set of tools cleans the joint, installs the clamp . . . often in only a quarter of an hour. SAVES TIME. SAVES MONEY and the repair is permanent. Designed for all conditions particularly where pavement repair costs are prohibitive. Such small opening repairs are scarcely noticeable when pavement is replaced.

Normac Clamps can be installed in large as well as small openings.

Norton-McMurray hold definite leadership in the development of methods for installation and rehabilitation work through small openings. We welcome the opportunity to help solve a problem you may have—tell us about it.

Write for our catalog describing our complete line of

COUPLINGS . . . FITTINGS . . . SERVICE TEES and ELLS . . . SLEEVES . . . COMPRESSION-END COCKS . . . METER BARS and BRASS FITTINGS for copper pipe.

6 inch Normac Clamp being lowered into hole for installation

6 inch Normac Clamp in service after installation

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE • CHICAGO 3, ILLINOIS

Method and product covered by U. S. Patents, Nos. 2,163,261 and 2,178,286.

CALENDAR

April

7-8..PCGA Accounting Section — Berkeley, Calif.

12-14..AGA Sales Conference on Industrial & Commercial Gas — Edgewater Beach Hotel, Chicago.

12-14..National Conference of Electric & Gas Utility Accountants—Hotel Statler, Boston.

13-15..Southwestern Gas Measurement Short Course — University of Oklahoma, Norman.

15-16..National Personnel Conference of the Gas Industry—Edgewater Beach Hotel, Chicago.

19-20..AGA Residential Gas Section, Eastern Natural Gas Regional Sales Conference—William Penn Hotel, Pittsburgh.

19-21..AGA National Purchasing & Stores Conference — Henry Grady Hotel, Atlanta, Ga.

21-22..PCGA Technical Section, Customers Service — Santa Barbara, Calif.

20-23..AGA Distribution, Motor Vehicles, and Corrosion Conference—Mount Royal Hotel, Montreal, Canada.

22..GAMA Automatic Gas Range Editors Conference — Hotel Pierre, New York.

22-23..Indiana Gas Assn. Annual Meeting — French Lick Springs Hotel, French Lick, Ind.

26-27..National Safety Council Public Utilities Section Executive Committee Meeting — Park Lane Hotel, Denver.

26-28..Mid-West Regional Gas Sales Conference — Edgewater Beach Hotel, Chicago.

26-28..Southern Gas Assn. Annual Convention—Houston.

May

2-4..Gas Compressors Institute. Legion Hall, Liberal, Kan.

4..NEGA Operating Division — Sheraton - Biltmore Hotel, Providence, R. I.

5..New Jersey Gas Association Home Service Conference — Military Park Hotel, Newark.

9-12..LPGA Convention — Conrad Hilton Hotel, Chicago.

10-14..AGA Commercial Gas School Chicago.

10-14..35th Annual National Restaurant Convention & Exposition — Navy Pier, Chicago.

12-13..PCGA Gas Supply & Transmission — San Francisco.

13-14..Public Utilities Advertising Assn. — Hotel Statler, Boston.

17-21..National Fire Protection Assn.—Statler Hotel, Washington, D. C.

18-20..Pennsylvania Gas Association — Pocono Manor Inn, Pocono Manor, Pa.

19-21..GAMA Annual Meeting — The Drake Hotel, Chicago.

24-26..AGA Production and Chemical Conference — William Penn Hotel, Pittsburgh.

27-28..Natural Gas & Petroleum Assn. of Canada — Prince Albert Hotel, Windsor, Ontario, Canada.

June

1-3..Edison Electric Institute Annual Meeting — Atlantic City, N. J.

2-3..AGA Research & Utilization Conference — Hotel Statler, Cleveland.

2-4..Gas Technology Short Course. Texas College of Arts & Industries, Kingsville, Texas.

20-24..Canadian Gas Assn.—Banff Springs Hotel, Banff, Alberta.

21-22..AGA Residential Gas Section, New York-New Jersey Regional Gas Sales Conference — Monmouth Hotel, Spring Lake, N. J.

27-29..Wisconsin Utilities Association Accounting Section — Dell View Hotel, Lake Delton, Wis.

28-29..Michigan Gas Assn.—Grand Hotel, Mackinac Island, Mich.

July

6-9..American Home Economics Association—San Francisco.

September

8-10..31st Mid-West Gas School and Conference, Iowa State College — Hotel Sheldon-Munn, Ames, Iowa.

8-10..Pacific Coast Gas Assn. — Victoria, British Columbia.

17-18..Maryland Utilities Assn., Fall Conference — Virginia Beach, Va.

28-29..Texas Mid-Continent Oil & Gas Assn. — Baker Hotel, Dallas.

October

7-8..California Natural Gasoline Assn. Annual Fall Meeting. Ambassador Hotel, Los Angeles.

11-13..AGA Annual Convention — Atlantic City, N. J.

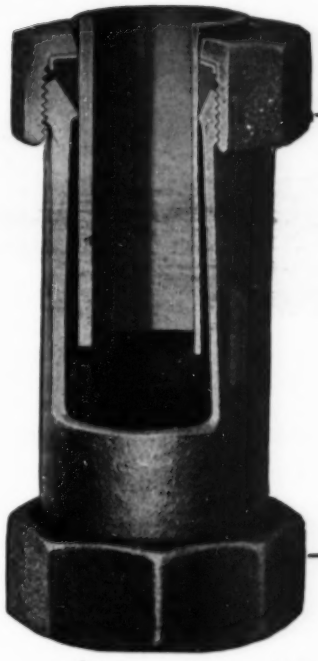
18-22..National Safety Council — Chicago.

November

1-5..National Metal Exposition—Chicago, Ill.

8-11..American Petroleum Institute—Conrad Hilton Hotel, Chicago.

17-19..Wisconsin Utilities Association, Electric & Gas Section, Technical & Sales & Service Divisions — Hotel Schroeder, Milwaukee.



NORMAC

Couplings, Sleeves and Fittings

for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.

Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

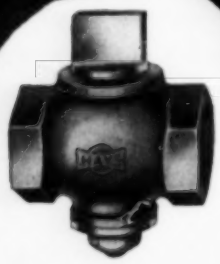
NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

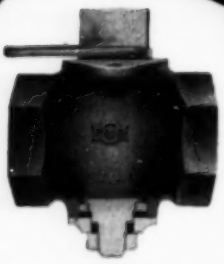
Couplings • Motor Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

that are TOPS

IT PAYS TO BUY HAYS



7405
Iron Body, Galvanized,
Bronze Plug Stop



7490
"Key-Lok" Tamper Proof Stop
Lockwing—Iron Body,
Bronze Plug

7500
Threadless Gas Stop
Iron Body, Brass Plug

Service Line Stops—Meter Stops
Appliance Stops

Tamper Proof and Standard Patterns

Iron Body with Brass Plug
Black or Galvanized
Also All Brass Stops

Flat Head—Flat Head with Lockwing

Full Range of Sizes

Quality Assured . . .
By Precision Machining—
Individual Testing—
Rigid Inspection

Quality Proven . . .
By Supplying the Gas Industry
for Over 80 Years

Standard Packaging for Easy Handling,
Space Saving Storage . . . Another HAYS First

Write for literature, or ask "The Man from Hays"

GAS SERVICE PRODUCTS
HAYS MANUFACTURING CO.
ERIE, PA.

tional formal luncheon. Wednesday will be Commercial Gas day.

Scheduled to appear on the program are R. J. Ruff, Catalytic Combustion Corp., who will discuss "Gas Clears the Air;" H. N. Ipsen, Ipsen Industries Inc., "Prepared Atmospheres From Available Fuel Gases;" Sheldon Lee, Minneapolis Gas Co., "Gas Is Really in the Production Line;" James F. Oates Jr., Peoples Gas Light & Coke Co., "What the PAR Program Is Doing for Industrial and Commercial Gas Service."

Raymond Little, new GAMA promotion manager, will discuss "Industrial and Commercial Gas — Past, Present and Future;" Gene Martin, Carl Byoir & Associates, "Make the Public Your Partner;" and W. D. Relyea, Public Service Electric & Gas Co., will present the industrial and commercial gas research report. In addition, there will be discussions on commercial incineration, automatic ignition, dealer relations, commercial water heating, and selling commercial gas cooking equipment.

Rauel Papich becomes AGA safety consultant

Rauel Papich

Rauel N. Papich, formerly field representative for safety services with the American Red Cross, has been appointed safety consultant of the American Gas Association. He succeeds William H. Adams, who retired recently.

During his association with the Red Cross, Mr. Papich contacted and worked with many industries interested in establishing accident prevention programs. In his new capacity he will serve as secretary of the AGA accident prevention committee.

In 1953 he helped make a survey to establish an accident prevention program for the American personnel assigned to the radio relay bases—a special assignment with the State Department's Voice of America program.

Accountants to meet for AGA-EEI-sponsored session

Every phase of utility accounting from customer relations to taxation will be covered at the National Conference of Electric & Gas Utility Accountants meeting at the Hotel Statler in Boston on April 12-14. The conference is sponsored jointly by the AGA and the Edison Electric Institute.

Tentatively scheduled are discussions of training methods by Beach J. McMillen, Cincinnati Gas & Electric Co., and the 1954 economic picture by Martin R. Gainsbrugh, National Industrial Conference Board.

Customer activity sessions will cover such

subjects as merchandise credit, customer accounting and customer relations problems, and orientation of supervisors. During a general activities meeting, new supervisor indoctrination, economic depreciation, accounts systems, revenue legislation, income tax administration, and depreciation accounting problems will be discussed. A panel will be devoted to management's evaluation of internal auditing, and luncheon groups will discuss customer collections, customer relations, and property records.

Trends in reporting to stockholders, financial reports to top management, and new uniform systems of accounts will be discussed on the last day of the conference. Also, electronic accounting machine developments will be described.

New Freedom Kitchen bureau producing movie

A 12½-minute color movie, devoted to a gas kitchen-dinette-laundry that has been specially designed for builders and incorporates latest work-saving features, is being produced by the AGA's New Freedom Kitchen and Laundry bureau.

The film, written and directed by RKO-Pathe's chief script writer and featuring Hollywood actors, will be released for national television and group showings. As the largest project of its type undertaken by AGA, this will be the official kitchen-laundry film of the National Association of Home Builders.

The movie portrays the problem of a young couple with a growing family in an old home and outdated kitchen who solve their problem by buying a new home, which has a New Freedom gas kitchen and laundry.

Industrial and commercial men to meet in Chicago

Top industrial relations executives from gas and electric utilities and pipeline companies will meet at the Edgewater Beach hotel in Chicago on April 15-16 for the sixth national personnel conference of the gas industry, which is held under the auspices of the general management section of the AGA. Joint sponsors of the conference are the personnel committee, the Great Lakes personnel conference, and the Midwest personnel conference of the AGA and the employee relations section of the Southern Gas Association.

First-day speakers will be Dr. Charles Roos, president of Econometric Institute, New York, who will discuss the use of business forecasts in present situations and Dr. Frederick H. Harbison, professor of industrial relations at the University of Chicago, who will present a comparison of management organization, outlook, and methods between the U. S. and Europe.

Dean H. Mitchell, president of Northern Indiana Public Service Co., Hammond, will discuss labor legislation and its effect on industrial relations at a Thursday luncheon meeting. A discussion on group morale and productivity with relation to the proper kind of supervision will follow.

On Friday morning, Dr. Robert Fleming, director of the Institute of Labor and Industrial Relations at the University of Illinois, will give his views on the causes of industrial peace in collective bargaining. He will be followed on the program by Karl B. Nagler, Peoples Gas Light & Coke Co., who will present an operating man's view of industrial relations.

The closing luncheon will be highlighted by a discussion on "The Economic and Social Reasons for Management Development," by Dr. Leon A. Bosch, associate dean of Northwestern University's School of Commerce.

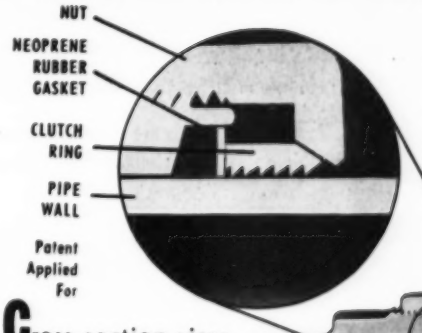
"Matchless" ranges to get first national promotion

The first national campaign on "matchless" gas cooking performances by automatic gas ranges will be highlighted by the AGA during April and May. This promotion complements the autumn Old Stove Round-Up.

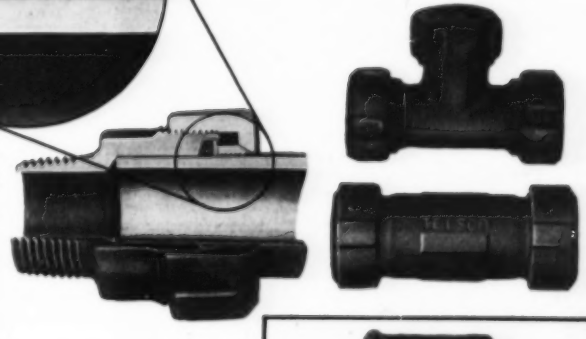
Two-way emphasis will be placed on the word matchless, which represents superior gas range performance as well as complete automatic ignition and operation of gas ranges. Smokeless broiling, baking, and cooking will be presented along with results of 34 months of field testing 1459 gas ranges to demonstrate the proven performance of the new automatic gas ignition systems.

Telsco®

MALLEABLE IRON FITTINGS GET AND HOLD A BULLDOG GRIP ON STEEL AND PLASTIC PIPE



Eleven different types, more than 100 different sizes, ½" through 2"



Cross section view of typical Telsco Fitting above shows how teeth of Clutch Ring (Patent applied for) bite into and grip pipe when nut is drawn up. The Neoprene Rubber Gasket, under pressure from the Clutch Ring on one end and the fitting body on the other, completely seals the connection against gas leaks.

Telsco Fittings are tested to hold at traction forces ranging from 1,450 to 3,600 lbs. They hold at hydrostatic forces ranging from 450 p.s.i. (on 2" pipe) to 8,250 p.s.i. (on ½" pipe)

Metal Stiffeners

Telsco Brass Stiffeners to stop Thermoplastic "cold flow" are available to use with Telsco Fittings on Plastic Pipe. Stiffeners are split to allow for off-diameter pipe, and flared on one end to allow free flow through the connection.

Available in

Couplings (Long and Short), Adapters, 90° Elbows, Tees, Fitting Reducers and Fitting Increasers.

Literature

Complete information about Telsco Fittings: Ask for your copy of *Price List C*, just off the press.

TELSCO FITTINGS DIVISION
5423 REDFIELD STREET, DALLAS 19, TEXAS

NEWS

Public sale planned for Gas Service Co.

With the announcement that it had cancelled a contract to sell its subsidiary, Gas Service Co. of Kansas City, Mo., to the Missouri Public Service Co. of Warrensburg for $32 million (see March GAS, page 73), Cities Service Co. plans to go ahead with its original plans to sell the $1.5 million shares of stock in a public offering.

Cities Service has set a Feb. 25 deadline for the transaction and declined to extend it past a March 15 hearing date set by the Kansas Corporation Commission, which had to approve the sale along with the Missouri state body. Missouri had previously endorsed the sale on Jan. 22.

The Kansas regulatory body had expressed skepticism that the "comparatively small" Missouri utility could manage the Gas Service Co. without jeopardizing Kansas service and rates. The Missouri PSC, in approving the sale, said it saw no evidence that the sale and eventual merger of the two companies would be harmful to the public or interfere with present supplies of natural gas to Missouri customers.

In a statement made by Missouri Public Service, it was stated that Cities Service "had twice made oral promises to extend the contract time," but had declined to execute a written extension.

Henry L. O'Brien, general counsel for Cities Service, said that his company originally preferred not to deal with the utility because of the potential complications involved in such a transaction. However, Missouri Public's bid, which was accepted, would have resulted in Cities Service receiving more than it would have realized through a public offering at the time of the submission of such bids.

T. T. Arden (center), executive vice president of Robertshaw, is joined by Mayor Sutter (third from right) and city councilmen in ground-breaking ceremonies for new $2.5 million plant of the company's Grayson Controls division at Long Beach, Calif.

Ground broken for Grayson Long Beach, Calif. plant

As part of an extensive national expansion program, Grayson Controls division of Robertshaw-Fulton Controls Co. has under construction a new 237,000-sq-ft plant in Long Beach, Calif. The Grayson division is presently located in Lynwood, Calif.

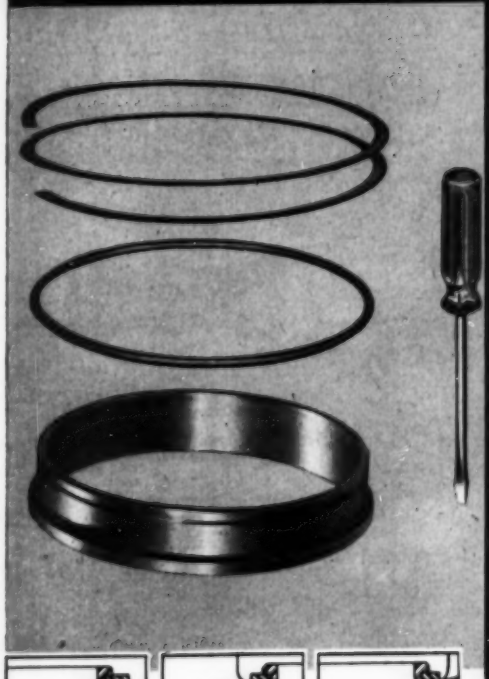
To be built at a cost of approximately $2.5 million, the new plant will increase the manufacturing capacity of the division. About 2400 people, with an annual payroll in excess of $7 million, will be employed.

Two factory areas will feature wide span

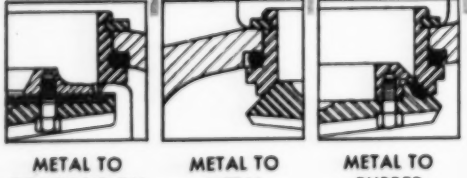
... announcing

REYNOLDS' REMOVABLE ORIFICES

in single district station and high pressure line regulators which has been in use 3 years



1. To remove orifice, a screw driver is the only tool needed.
2. Orifice may be had in any metal, normally stainless steel.
3. Types—Seats for orifices:
   Flat Disc—Composition or Leather
   Metal to Metal
   Metal to Metal with "O" ring
4. "O" ring between valve body and seat assures perfect parallel seating as well as perfect height seating. Does not require close valve height adjustment.
5. Valve seats may be sized as much as three regulator sizes smaller. For example, a 12" regulator may have inserted valves the size of 10", 8", 6" regulators.



METAL TO COMPOSITION VALVE SEAT | METAL TO METAL VALVE SEAT | METAL TO RUBBER VALVE SEAT

GAS CONTROL Since 1892

Reynolds Gas Regulator Co.

ANDERSON, INDIANA, U. S. A.

bays of 100 ft and overhead clearance of 16 ft, with high intensity fluorescent lighting throughout. The attached office area of the steel and concrete building will be completely air conditioned.

GAMA continues campaign to remove excise tax

Treasury Secretary George M. Humphrey, who said that he would approve "a selective reduction" in excise taxes, is being urged to consider eliminating levies on appliances and equipment that are essential to home construction and modernization as well as to public health and comfort.

H. Leigh Whitelaw, managing director of the Gas Appliance Manufacturers Association, said in a telegram to Humphrey:

"Excise taxes on such items as gas ranges, refrigerators and water heaters cost the consumer heavily without providing the government with sufficient needed revenue. In appliances, which represent a considerable investment by the home builder, the excise levy represents a 'last-straw' deterrent to sales and to the modernization of more than 20 million homes now past the age of 30 years."

Besides the "evil of pyramiding" there is the companion evil of inflation, the telegram continued.

"Furthermore," the telegram said, "most gas appliances, as installed, are permanent parts of the realty and, as such, have been considered essential even by government bureaus which, however, have not moved to lift the burden of excise taxation from these items."

". . . These taxes are levied against certain segments of business at rates which are injurious while other industries which cater to the same buyers are tax free.

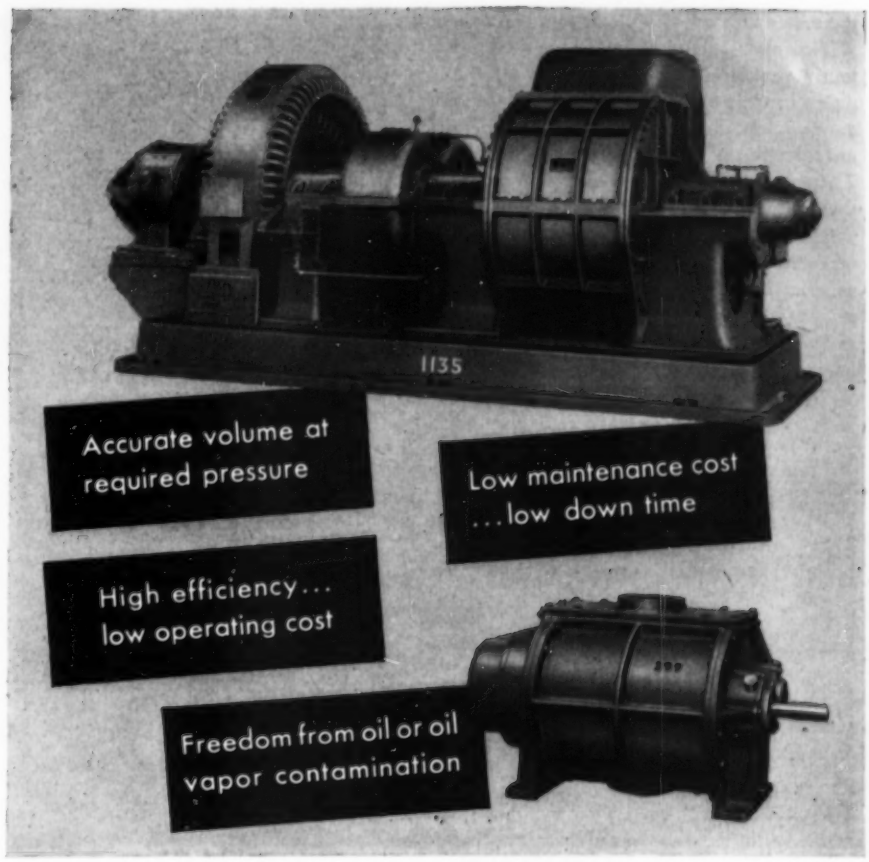
"The result is an unfair burden on industries which are important to the national economy. What's even worse," he added, "is that they result in a kind of 'rationing by pocketbook' of the necessities of modern living."

Good operating results for new gas telemeters

Early "returns" on some five months of trials with the new gas telemeters are in and are indicative of good operating results, according to the manufacturer.

The telemetering apparatus, through which domestic meter readings are transmitted to an exterior location for easy reading from the yard, is now on test in some 60 gas companies throughout the country. Out of 1000 devices shipped, three have shown evidence of malfunction, but extensive tests under varying climatic conditions have been favorable, according to Sangamo Electric Co., the manufacturer.

One utility that has the devices on trial reports that during a midwinter cold spell when the maximum temperature was only 0°F and at the coldest point it was —27°,


1135
Accurate volume at required pressure
Low maintenance cost ...low down time
High efficiency... low operating cost
Freedom from oil or oil vapor contamination

LOOK FOR THE "BIG 4"
WHEN YOU BUY BLOWERS

Successful over-all performance of blowers calls for continuous, long-time ability to meet these basic requirements. In any specific case, one may be more important than another. But, when you select Roots-Connersville equipment, you sacrifice none of these four essentials. That is true, whether your requirements are for a whisper of air or for a tornado. You'll find the R-C range of capacities so extensive that you can very closely match your needs, with resulting economies in both first cost and operating cost. Further, you have the choice of either Rotary Positive or Centrifugal Blowers, from the exclusive R-C *dual-ability* line.

The ability to deliver blowers with these fundamental values comes from our century of specializing in problems of handling gas and air. The proof of this ability is readily found in our list of long-time customers who have gained complete satisfaction by entrusting their blower problems to Roots-Connersville. Ask us about your present or future needs in equipment to handle gas or air.

ROOTS-CONNERSVILLE BLOWER
Reg. U.S. Pat. Off.
A DIVISION OF DRESSER INDUSTRIES, INC.
454 Oregon Ave. • Connersville, Indiana
Specialists in handling gas and air

the meter functioned without failure.

Two major meter manufacturers are currently preparing costs on installing the telemeter in their meters as delivered, and they may soon be able to offer tinned steelcase meters with the transmitter installed therein. These manufacturers also have run exhaustive tests on the device, with good results.

The utility testing program was undertaken as a means of verifying laboratory experiments. Test periods range from four months up, depending upon local conditions and the methods adopted by the individual utility.

The obvious advantages of such a device, such as improved customer relations, will have to be weighed against field results and capital investment considerations. However, the rising costs of labor for meter reading, as well as local difficulties in obtaining readers, have prompted some companies to consider relocation of present meters out-of-doors, according to the manufacturer.

Test installation of gas telemeter on the roof of a building where the telemeter is exposed to extreme cold weather.

Appliance shipments up for January over last year

January shipments of gas burning ranges, water heaters, and boilers were all up over the December 1953 figure, although shipments of heating equipment and ranges were both down from what they had been in January 1953.

GAMA reports that 138,600 gas ranges were shipped in January, compared to the 132,400 in December and the 169,200 in January 1953.

In January of this year, 26,900 gas-fired furnace units were shipped, somewhat below the 32,300 shipped during December and the 31,100 shipped in January 1953. Gas-operated boilers for househeating systems during January increased by 7.4% over the same month last year.

Shipments of automatic gas water heaters during January increased by 29,400 units over the previous month. This January's total of 167,200 is down from the 184,000 of January 1953.

For the year 1953, 2,125,700 water heaters were shipped for an 11.3% gain over 1952; and 2,181,300 ranges went out in 1953, a gain of 5900 over the 2,175,400 shipped in 1952.

"Sell up" range promotion under way in California

A "sell-up" gas range campaign is now under way in California with the objective of inducing customers to buy higher quality and higher priced gas ranges by offering a special $35 allowance off the list price. The campaign is sponsored by the Gas Appliance

"This Quality Control Number is Your Proof that M·S·A FIRST AID KIT Items are Fresh, Pure, Sterile"

Every step in manufacture, all supplies that go into the new M.S.A. First Aid Kits are keyed to the number stamped on each Unit "D" package. This identity is your assurance of *individual responsibility* on our part . . . the best possible guarantee of product protection to you.

MORE THAN 60 ITEMS GIVE YOU COMPLETE SELECTION

You name it, we have it! 12 different packages of antiseptics; 15 various kinds and sizes of bandages and dressings; over 21 burn treatments; and more than 15 miscellaneous items, including eye treatment, snake bite kits, poison ivy ointments, and many others. Write for details.

MSA
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES CO.
201 North Braddock Avenue, Pittsburgh 8, Pa.
At Your Service: 82 Branch Offices in the United States and Canada

Society of California, which is serving as a promotional organization for the Pacific Gas & Electric Co. and Coast Counties Gas & Electric Co.

The $35 inducement is available on makes of ranges manufactured or distributed by members of the society's gas range sticker plan and which retail at a price of $279 or more. The cost of the customer inducement is shared equally by the retail dealer, the manufacturer or distributor, and the society.

Extensive utility newspaper advertising and special bill stuffers are supporting the campaign.

Worthington Corp. acquires assets of L. J. Mueller

An agreement has been reached for the transfer of the net assets, name, and goodwill of the L. J. Mueller Furnace Co., Milwaukee, to the Worthington Corp. in exchange for Worthington common stock. A special meeting of preferred and common stockholders of Mueller Furnace will be called to vote upon and approve the proposal.

Hobart C. Ramsey, Worthington president, states that the Mueller plant and facilities would be operated as the Mueller Climatrol division of Worthington and that the entire working force and management of the present staff will be continued. Harold P. Mueller heads the Mueller organization.

The merger will unite two of the leading manufacturers in their respective fields—Mueller in home heating and Worthington in air conditioning. The full line of Mueller Climatrol products will continue to be manufactured at Milwaukee and Worthington will continue to manufacture its air conditioning equipment at Holyoke, Mass. and Decatur, Ala.

Safety record good in '52 for gas and oil industry

Although complete records covering injuries to employees were not available for the entire gas and oil industry, reports from nearly 3500 operations, large and small, showed a favorable safety record in 1952, according to a Bureau of Mines report.

Compared with the previous year, injuries were not as frequent or as severe during 1952, and the overall injury experience was better in only one year (1950) of the 11-year period during which statistics have been collected and recorded. The combined frequency rate, fatal and nonfatal, of 12.72 injuries per million man-hours of employee exposure to hazard was 4% lower and the severity rate of 1.23 days per thousand man-hours was 8% lower than the respective rates of the previous year. Man-hours of work performed in 1952 totaled over a billion and a quarter, the greatest in the statistical history of the industry.

Worthy of note was the improved safety record of the gas pipeline department. The combined frequency and severity rates of

One Sherman Power Digger Does the Work of *Ten* Men!

The problems of working restrictions caused by limited headroom and closely-spaced columns were solved when this Sherman Power Digger was used to dig trenches for sewer and electrical connections in the basement of the new Oakland Hospital in Royal Oak, Michigan.

In a race against winter, it was decided to pour concrete for upper floors and postpone the basement digging. When trenching could be started, the tractor-mounted Sherman Power Digger was lowered by crane through a small areaway into the basement.

With a single operator, the machine dug a criss-cross pattern of trenches totaling 1500 feet, in hard, dry clay, in just 30 hours. Subcontractor Robert Patton, owner and operator of the digger, estimates that the same digging by hand would have required 320 man-hours.

Thus, even on jobs where it is expensive, impractical, sometimes *impossible* to use heavy equipment . . . Sherman gives you all the advantages of power digging! The Sherman Power Digger is compact, flexible, highly maneuverable . . . gets in and out of tight spots easily . . . moves from job to job at top tractor speeds. Initial cost is surprisingly low, and maintenance is simple and inexpensive. Get all the facts on Sherman Power Diggers now. Write for free literature J12, without obligation.

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Designed, Engineered and Manufactured Jointly by
SHERMAN PRODUCTS, Inc.
Royal Oak, Michigan
WAIN-ROY CORPORATION
Hubbardston, Mass.

•

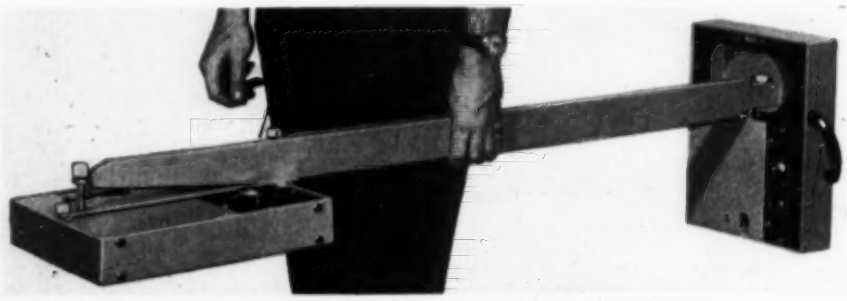
Patent No. 2,303,825
Other patents pending

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN

"SEE" BELOW
ANY SURFACE . . .
Pipes-Cables-Valves
Other Equipment

The Wilkinson Electronic Line Locator Reveals Sub-surface Metallic Structures, Accurately Indicates Depth Under Ice, Snow or Cement!

Pipe "signals" location through headphones.



Eye and ear work as a team. Shows depth as well as location.

Recently a *one-man operated* Wilkinson Line Locator gave the exact location of $16,000 worth of pipe lost in the Gulf of Mexico—*under 34 feet of salt water!* This is just one of many stories of positive performance available from our files about this *precision* instrument.

Chosen by leading utility companies for their toughest field assignments, the Wilkinson Pipe Locator—*and one man*—can help *you* do a better, faster, more economical job of locating sub-surface metallic structures of every description. Why not write for the full story right now?

WILKINSON PRODUCTS COMPANY
3987 Chevy Chase Drive • Pasadena 3, California • SYlvan 0-4314

SAVES $ LOTS OF $

. . . on pipe runs under streets, highways, pavement, gardens, etc.

REG. U. S. PAT. OFF.

HYDRAUGER*

HY-25C

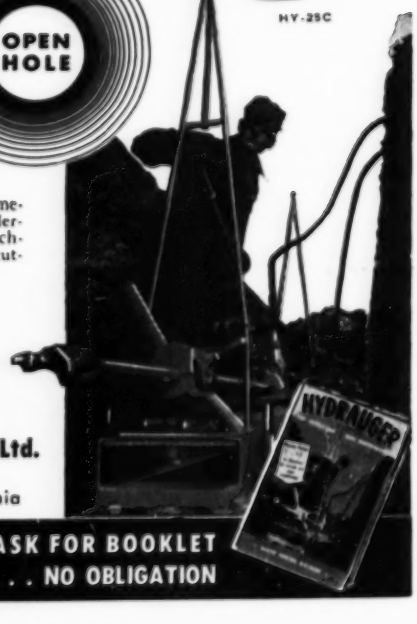
OPEN HOLE

AVOID TIME WASTE

Hydrauger is a modern, time-saving way to install underground pipe . . . avoids trenching, backfilling, pavement cutting, etc.

2" to 24" BITS and REAMERS

HYDRAUGER CORP. Ltd.
681 Market Street
San Francisco, California



*Earth Boring Tool

ASK FOR BOOKLET . . . NO OBLIGATION

13.63 and 1.20 were 29 and 12% lower than the corresponding rates recorded in 1951. In the departments of natural gasoline, oil pipeline, refining, and marketing, injuries occurred less frequently than the national average and the severity rates in the departments of exploration oil and gas pipelines, refining, and marketing were lower than the national average for the industry.

ElectroData Corp. formed by Consolidated

The ElectroData Corp. has been established as a wholly owned subsidiary of Consolidated Engineering Corp., Pasadena, Calif.

The new corporation will continue engineering, manufacturing, and sales activities formerly conducted by Consolidated's computer division, which recently announced the Model 203 electronic digital computer, an "electronic brain" designed to bring high-speed electronic data processing to business, industry, and science at low cost.

Philip S. Fogg will serve as president of the new firm and will continue as president and chairman of the board of the parent company. Other officers of ElectroData are James R. Bradburn, executive vice president; L. P. Robinson, vice president; Victor J. Pollock, secretary-treasurer; and Joseph B. Rice, assistant secretary-treasurer.

Cascade Natural buys Consolidated Gas stock

The outstanding capital stock of Consolidated Gas Co., which operates in Toppenish, Zillah, Granger, Sunnyside, Grandview, Prosser, and Mabton, Washington, has been sold to Cascade Natural Gas Corp., Seattle. (See January GAS, 85-86).

Cascade Natural, headed by Stewart Matthews, also has mergers nearing completion whereby Cascade will own and operate the gas utilities in Bellingham and Wenatchee, Wash. The company will continue to operate in the above cities on a manufactured and liquid gas-air basis until natural gas is available.

Utility rates affected in recent decisions

Several decisions affecting gas rates for utilities have been made recently.

Rhode Island approved on March 5 an amended natural gas rate schedule that would cut $88,000 a year from the Providence Gas Co.'s revenue from general domestic users. For the first time, rates pinned to the operation of the company with natural gas became effective, replacing schedules which for the past few months were arithmetical translations of old manufactured gas rates. Slightly reducing rates originally filed last August, the company's new schedule followed a PUC order to amend natural gas tariff to reduce revenues

by $100,000 a year on the basis that expansion of sales through an attractive rate for heating would more than offset the revenue lost.

In the first general increase asked in 36 years, Oklahoma Gas & Electric Co., Oklahoma City, will ask the state corporation commission for an increase to boost revenues $2.6 million a year, or about 10%.

A $5 million annual increase has been granted Peoples Gas Light & Coke Co., Chicago, that will affect about 40% of the company's 950,000 Chicago customers. It is the second multimillion dollar increase granted the utility in less than a year.

In Georgia, several communities plan to fight a proposed increase sought by the Atlanta Gas Light Co.

Ohio's State Utilities Commission has granted the United Fuel Gas Co. an emergency rate increase for two areas it serves in Ohio.

District Judge C. B. Elwell of Havre, Mont., has thrown out of court Attorney General Olsen's challenge of increased natural gas rates granted the Montana Power Co. The judge said the attorney general's complaint could not be amended to meet objections of the Montana Public Service Commission and Montana Power. The defendants successfully objected to his challenge in his role as attorney general.

Rhode Island asks for company check of lines

Rhode Island gas companies have been requested by the state public utility administration to make a thorough investigation of their pipelines to minimize potential explosion hazards.

The request resulted from investigations of an explosion that revealed that the Narragansett Electric Co.'s line ran partly through land composed mostly of oystershell fill. A joint had become badly corroded by the action of the lime in the shells and by the constant presence of tidal water in the fill. An unknown strain had apparently broken open the joint at the corrosion line.

The PUA urged the gas companies to conduct a thorough investigation of their distribution systems "to determine the extent of present leakage and unaccounted for gas losses, and establish a definite policy for the prevention of gas leaks and potential explosion hazards, and make all repairs necessary" to reduce them to a minimum.

Analysis of hydrocarbons undertaken by 76 labs

Seventy-six plant and research laboratories of 48 oil companies and nine commercial laboratories are participating in a hydrocarbon analysis project sponsored by the Natural Gasoline Association of America. The laboratories are analyzing a synthetic liquid sample, a de-ethanized natural gasoline, blended for this purpose by the special products department of the Phillips Petroleum Co. Exact position of the sample is known only by the blender.

While most of the analysis will be made by low temperature distillation, analysis will also be made by mass spectrometry, infrared, the Fracton method, and absorption index.

A second phase of the same project will be the analysis of a natural gas sample by the same group. Although considerable difficulty was encountered in obtaining gas of sufficient uniformity to guarantee that tthe large number of samples required would be identical in composition, it is believed that the difficulty has been overcome and individual containers are now being filled from a source in one of the older Oklahoma fields.

NGAA President Frank Perry stated the objective of the series is to determine and correct analysis procedure and to elminiate human errors in the laboratory.

Safety council announces 1953 contest winners

Out of the 215 companies vying in the 1953 safety contest among utilities conducted by the National Safety Council, 23 had perfect records at the end of 12 months. The final figures showed a 3% decrease in injuries compared with 1952 and a 9% decrease in final rate.

The January-December frequency rate for

MAKE JOINTS

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MECHANICAL JOINT CAST IRON PIPE

Mechanical Joint has rapidly become the leading type joint for cast iron pipe for water or gas. A McWane-Pacific Boltite mechanical joint pipe line can be laid fast by untrained workmen, using only a ratchet wrench to make the joints. No lead pot, no calking tools.

The Mechanical joint is designed on the stuffing box principle—a thick rubber-compound gasket, triangular in cross section, being compressed by a bolted gland or follower ring. The joint is bottle tight, but flexible to allow settlement, expansion or contraction of the pipe line. Mechanical joints are interchangeable with fittings, valves, hydrants and pipe made by all leading manufacturers.

For complete information, wire or write McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama, or PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales Offices in principal cities.)

McWANE PACIFIC PIPE Lasts for Centuries

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MEDIUM UTILITY DITCHER

...for Greatest Dollar Value!

Buckeye's brand new model 303 is the outstanding wheel-type ditcher for its size and capacity developed in 60 years of Buckeye experience! . . . Low in first cost and easy to maintain it has been "contractor proven" in a wide variety of soils and climates . . . Digs to 5 ft. depths in 10, 12, 14, 16, 18 and 20 in. cutting widths at digging speeds up to 18 f.p.m. . . . Cuts the right size ditch for most applications in city, county and utility work and is ruggedly built to withstand the many abuses usually encountered . . . Small and compact with low ground bearing pressure . . . Positive depth control in hilly and rough terrain . . . Your dealer has complete details and —

Only Buckeye has a Ditcher for every Ditching Job!

GAR WOOD INDUSTRIES

all divisions was 7.7%, a —9% change from the previous period; for combination gas and electric companies the frequency rate was 6.67, a —14% change; for gas, the frequency rate was 10.33, a —4% change; and for electric, the frequency rate was 7.68, with a —7% change.

Top winner in the combination division, Group A, was Consolidated Gas Electric Light & Power Co. of Baltimore, with a 1.71 12-month rate. Group B winner was Central Illinois Ligh Co., Peoria; Group C, Interstate Power Co., Dubuque, Iowa; Group D, Lake Superior District Power, Ashland, Wis.

Top winners in the gas division are Peoples Natural Gas Co., Pittsburgh, Group A; Equitable Gas Co., Pittsburgh, Group B; Nashville (Tenn.) Gas Co., Group C.; and the Water & Gas Department of Duluth, Minn., Group D.

The following companies had the best no-injury records among those submitting reports in accordance with a rule that provides that honorable mention certificates will be awarded in each group to the unit (not a trophy winner) having the greatest continuous man-hour exposure without a disabling injury during the period of the contest:

Combination: Gulf States Utilities Co., Beaumont, Texas, 1,066,798 injury-free man-hours; New Orleans Public Service Inc., 1,740,024; Missouri Public Service Co., Warrensburg, Mo., 361,600; Superior (Wis.) Water, Light & Power Co., 153,253.

Gas division: Ohio Fuel Gas Co., Columbus, had 1,793,192 injury-free man-hours; Metropolitan Utilities District, Omaha, 443,699; Springfield (Mass.) Gas Light Co., 324,024; and Rio Grande Valley Co., 224,154.

Blue Flame Progress show conducted by Long Island

For the first time in the area, architects, builders, plumbers, appliance dealers, and sheet metal workers viewed a variety of major gas appliances in one complete showing recently when the Long Island Lighting Co. presented its Blue-Flame Progress Exposition in Mineola, N. Y.

Held at the Garden City hotel's main ballroom, the exposition provided members of the building and associated businesses with first-hand information on technical data and installation procedures for the various models and makes of gas appliances with which they will be working during the coming year.

News Notes

Consolidated Edison Co. of New York is seeking PSC approval of a plan to bring natural gas into Manhattan and additional areas of the Bronx. The company is now piping gas to 670,000 consumers in Manhattan and 430,000 in the Bronx. The proposed changeover, which would cost an estimated $22 million and take four years for

completion, would save $4.7 million in operating expenses, ConEd estimates.

It has been ruled by an Ohio Court of Appeals that a gas heating appliance dealer cannot recover damages from a local gas utility that failed to comply with orders of the Ohio PUC restricting the number of new consumers to whom gas could be furnished, even though the dealer may have been deprived of business.

Pacific Gas & Electric Co., San Francisco, has received California PUC approval to proceed with consolidation of Pacific Public Service and its subsidiary, Coast Counties Gas & Electric Co., with PG&E.

Southern California Gas Co., Southern Counties Gas Co., and the Pacific Coast Gas Association are participating in the promotion of Castles in the Woods, a luxury-home exposition now under construction in the Royal Woods estate-site development of Sherman Oaks, Calif. Proceeds from the home show will go for a proposed children's leukemia hospital.

The first copper-finished refrigerator, Servel's 1954 automatic Ice-Maker, was unveiled recently. The freezer compartment door is plated with satin-brushed copper and the scuff plate at the bottom of the refrigerator is finished to match the door .

A 24,000-sq-ft addition to its Oakland (Calif.) warehouse is under way by the Howard Supply Co. The expansion will enable Howard to carry increased stocks of industrial supplies, pipe, abrasives, etc. Completion is scheduled for late April or early May.

The Flotation Co. Inc., Elizabeth, N. J., is now offering inspection, repair and maintenance services for water-sealed gas holders. Arthur C. Loveny is handling the new service.

North Continent Utilities Corp., Chicago, a holding company, has entered into a process of liquidation. It is the parent company of Great Northern Gas Co. Ltd., Saulte Ste. Marie, Canada.

For acceptable ideas to improve the company's products and production methods, employees of Servel Inc., Evansville, Ind., received a total of $15,868 in 1953, the largest sum paid in the 19 years that the suggestion award plan has been in operation. Out of the 1238 suggestions, 326 were accepted and paid for. In the 19 years, a total of $124,334.75 has been paid out.

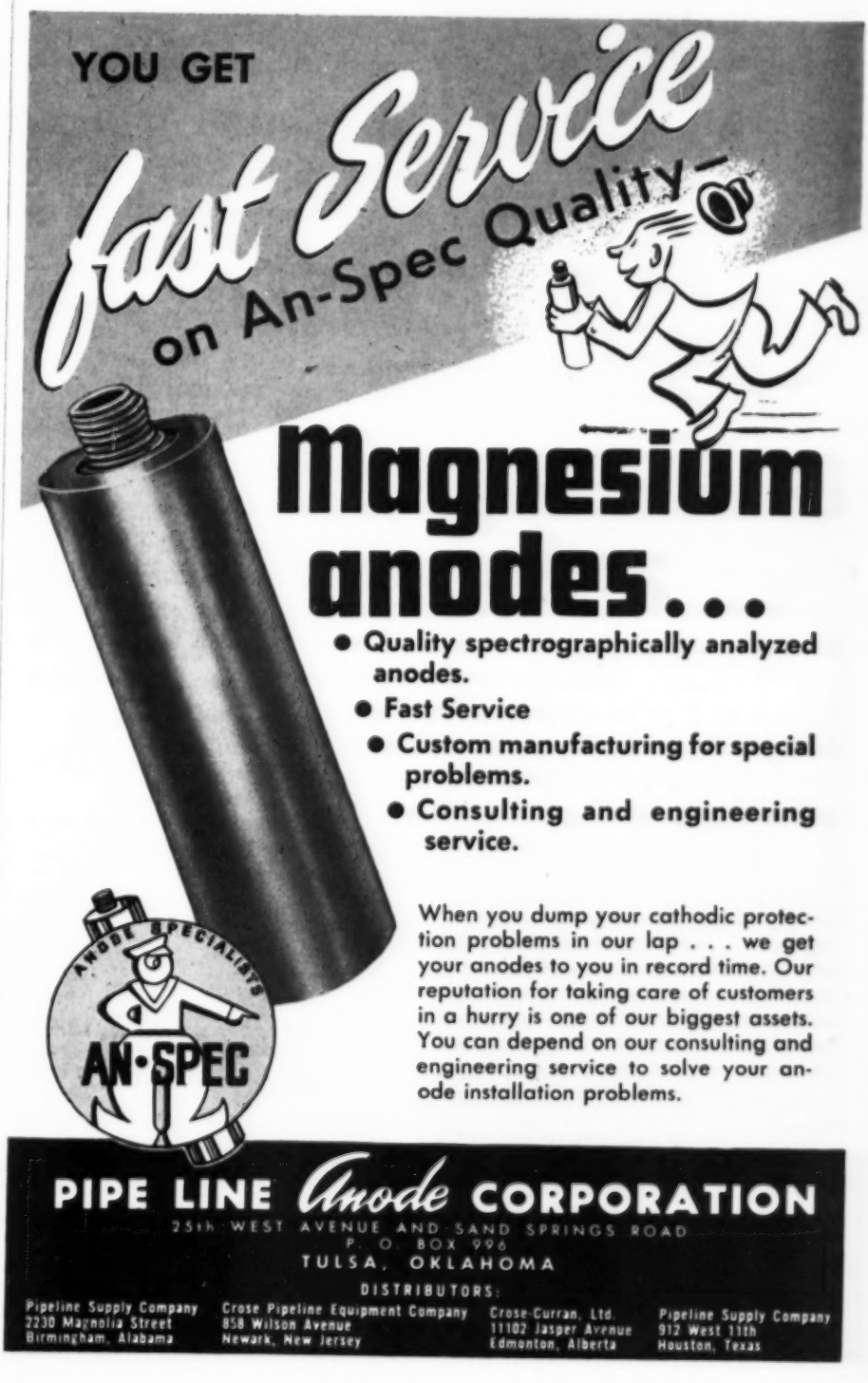
After a year of work, the search for natural gas in Great Britain seems likely to bring results, with the discovery of gas at Whitby in Yorkshire. Although regarded as promising, it still remains to be proved whether the gas exists in sufficient volume to justify exploitation. The Gas Council will spend one million pounds over the next five years to determine how extensive such reserves may be and to what use they can best be put.

Robertshaw-Fulton Controls Co. has received a certificate of cooperation by the Mutual Security Agency "for furnishing technical assistance to the peoples of friendly countries."

Six new members have joined GAMA, bringing membership to 594. They are: All-American Metal Products Co., Philadelphia; Chandler Co., Cedar Rapids; Troop Water Heater Co., Pittsburgh; Gibraltar Corp. of America Inc., Brooklyn; Welsbach Corp., Philadelphia; and Taymouth Industries Ltd., Toronto, Can.

Long-range weather services will be provided by a recently established company, Weather Trends Inc., New York.

Roots-Connersville Blower, a division of Dresser Industries Inc., is celebrating its 100th year of existence. From the simple rotary positive blower, which the company developed and started building 100 years ago, Roots-Connersville equipment now includes both rotary positive and centrifugal units, gas pumps, meters, vacuum pumps, inert gas generators, and the newest development, the Spiraxial compressor.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◀ DETECTS, TRACES and CENTERS PIPE, CABLE, ETC.
◀ ESTIMATES EXACT DEPTH
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A crystal ball might be one way to locate buried pipe or cable at an excavation site. But . . . a *better, safer* and *more efficient* way is to use the new, improved Detectron "505" that accurately pinpoints the exact length, depth and location. *Stop guessing —and be sure!*

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The Ohio Fuel Gas Co. Columbus, Ohio

Literature on request — address Dept. G

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People

Promotions

CHARLES O. SLABY has been named manager of the new western zone office of the Coleman Co., which was opened in Omaha recently. Assisting him are PAUL W. DE GOOD, HARRY H. PIKE, ROBERT E. LYDA, and LEWIS WHITE (regional sales managers) and ELVIN D. SANDIDGE and CHARLES E. YEOMAN, service engineers. The new zone comprises the states of Nebraska, Colorado, Idaho, Iowa, Kansas, Minnesota, Missouri, Montana, Nevada, Oklahoma, Oregon, South Dakota, Utah, and Washington.

BRUCE W. CONOVER, assistant engineer of the company since 1953, has been named assistant to the general superintendent of operations of the South Jersey Gas Co., Atlantic City.

Robertshaw-Fulton Controls Co. has appointed JOSEPH C. MCCARTHY as Canadian sales representative for the Robertshaw Thermostat, American Thermostat and Grayson divisions. He will headquarter in Toronto.

Joseph Kahn
Peoples Gas

J. C. McCarthy
Robertshaw

The Peoples Gas Light & Coke Co., Chicago has appointed JOSEPH KAHN assistant manager.

RICHARD W. CAMP, who has been vice president of Consolidated Gas Utilities Corp., Oklahoma City, since 1946, has been elected president of the company following the resignation of NORMAN HIRSCHFIELD. CURTIS B. DAY, who has been general manager in charge of operations, has been elevated to vice president.

B. P. DAHLSTROM has been named rate engineer of the Public Service Electric & Gas Co., Newark, N. J., succeeding the late Howard H. Agee. EDGAR L. HARRIS has become assistant to the rate engineer.

CONRAD C. MOUNT has been named vice president, director, and general counsel of the Cities Service Gas Co., Oklahoma City.

MERTON F. MACGREGOR has been promoted to gas plant superintendent of the

Connecticut Light & Power Co.'s Norwalk plant, succeeding JOHN C. MILLER, who resigned to become superintendent of gas of the Stamford division of the Connecticut Power Co.

JULIAN F. WARREN, who was formerly merchandise manager, has been named director of advertising and sales promotion of the Coleman Co. Inc., Wichita, Kan. He succeeds the late TOM GIBBONS. LELAND G. GINN becomes merchandising manager.

ROBERT O'HARA has transferred from the application engineering department of the Fielden Instrument division, Robertshaw-Fulton Controls Co., Philadelphia, to the Detroit staff as a sales engineer.

HARRY L. MCANALLY has been named land agent for the Peoples Natural Gas Co., Pittsburgh, following the retirement of GEORGE A. FRANZ.

American Meter Co. has announced the appointment of DONALD C. WILEY, formerly vice president-research, to the post of vice president-engineering and research, with headquarters in Erie, Pa. The company has also named JAMES W. BURG as factory manager of its orifice meter assembly plant and warehouse at Dallas.

D. C. Wiley

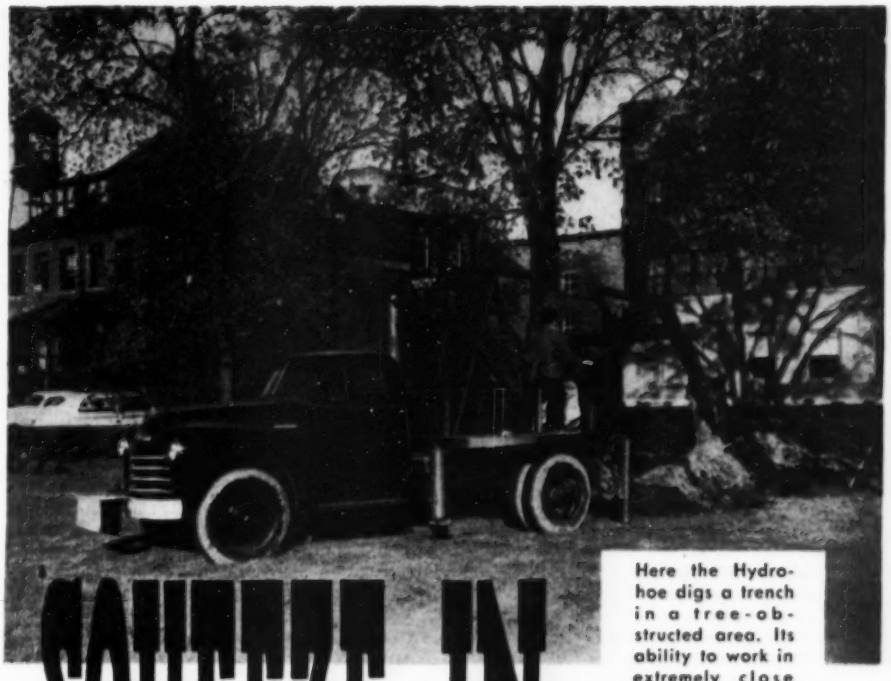
J. W. Burg

American Meter

Recent staff appointments at Pittsfield (Mass.) Coal Gas Co. include: EVERETT A. KELSEY, vice president in charge of sales; J. RICHARD COTTRELL, accounting supervisor; WILLIAM R. STEVENS, operating superintendent; ALDO ORSI, purchasing agent and general storekeeper; JAMES KELLY, general foreman of the distribution and production departments. Retiring are LEROY F. KELLY, treasurer and director; THOMAS F. MURPHY, sales manager; and THOMAS F. PLUNKETT, vice president, director and purchasing agent.

ROBERT D. HUNTOON has been appointed as associate director for physics at the National Bureau of Standards. In addition, DR. WALLACE R. BRODE, formerly associate director for research, is now associate director for chemistry, and NICHOLAS E. GOLOVIN, formerly assistant director, is now associate director for administration.

WALLACE J. HOEING has been promoted to the post of sales manager of the air conditioning division of Servel Inc., Evansville,



Here the Hydrohoe digs a trench in a tree-obstructed area. Its ability to work in extremely close quarters often permits the Hydrohoe to handle jobs normally requiring expensive hand labor.

SQUEEZE-IN SPECIALIST

BUCYRUS ERIE HYDROHOE

For trenching, valve pit digging, and leak repair work the all-hydraulic Hydrohoe is the stand-out performer, especially when the work requires squeezing into tight places. Here's why:

1. **Hydraulic outriggers provide outstanding stability.**
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5. **Can be converted to crane in amazingly short time — right in the field.**

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For Quick Profits

LET "MRS. AMERICA" HELP YOU SELL . . .

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TRADE MARK
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. . . IT'S THE AUTOMATIC GAS-FIRED INCINERATOR!

Cash in NOW on Mrs. America's promotion of Incinor, the **proven** unit. Over 30 years of dependable daily service in thousands of homes.

Easy to install in either utility room or basement — trouble-free — no service.

Write TODAY for more details!

Approved by A.G.A.

INCINERATION DIVISION

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THERE'S NO SEAL LIKE RECTORSEAL

for
- **high quality**
- **low price**
- **service**
- **leak-proof sealing**

Use Rectorseal #2 on threaded connections in service lines, meter loops, appliance connections, swing joints, and all others on lines carrying natural or manufactured gas. It holds odorants, too! Compare Rectorseal #2 quality and price with any other thread compound, and you'll see why so many utilities are changing to this dependable, positive, economical, leak-proof thread sealing compound.

Your supply house has it or can get it for you.

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Handiest Location in PITTSBURGH

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On your next business trip, make the PITTSBURGHER your headquarters. 400 outside rooms . . . bath . . . radio . . . circulating ice water . . . television. Air conditioned dining rooms, function rooms and sleeping rooms. Garage service.

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ATlantic 1-6970

Ind., succeeding H. R. NIELSEN, who has been promoted to manager. Servel has also promoted CARL E. DEIG to production control manager. STANLEY W. DUHIG, chairman of the board of Southern Clays Inc., is a newly elected member of the Servel board of directors, and EDWARD L. HART has joined the company as manager of civilian quality control.

W. E. MCCOMAS has been promoted to the post of district manager for the Howard Supply Co., Los Angeles. He had been manager of the company's order department.

WILBUR E. COMBS has been named assistant manager of sales development in the mechanical goods division of the United States Rubber Co.

United Gas Improvement Co., Philadelphia, has announced the following changes:

GERALD C. MARRS, formerly sales manager of the Harrisburg division, is now industrial sales manager for UGI; RUSSELL W. UHLER, general manager of the Lebanon Valley district, succeeds Mr. Marrs; and HERBERT WOLPERT, special operating assistant in Harrisburg, succeeds Mr. Uhler in the Lebanon position.

T. A. Kelly

C. H. Horne

Rheem Manufacturing

CARL H. HORNE, northern California regional manager of Rheem Manufacturing Co. and former vice president of the Alabama Gas Corp., Birmingham, has been promoted to assistant general manager of the western division; THOMAS A. KELLY, formerly manager of the Philadelphia plant, to the newly created post of manager of manufacturing planning with offices at company headquarters in Richmond, Calif.; and ANDREW W. HUGHES to eastern regional manager with headquarters in Burlington, N. J.

HARRY B. MCCLURE has been appointed president of Carbide & Carbon Chemicals Co., New York, succeeding DR. J. G. DAVIDSON, who becomes chairman of the board. Mr. McClure was formerly executive vice president.

Servel Inc.'s air conditioning division has appointed NILS D. SELLMAN air conditioning manager of the eastern region, headquartering in New York, filling the vacancy created by the elevation of WALLACE J.

HOEING to sales manager of the division. PATRICK B. KRAPFL, formerly air conditioning zone manager, succeeds Mr. Sellman as southern regional manager, with headquarters in Atlanta.

Creation of the technical operations department in the Pittsburgh group of the Columbia Gas System has resulted in the following changes: H. R. WEITZEL becomes superintendent of the new department; G. G. DORMER, assistant chief engineer, becomes assistant superintendent of compressor stations, succeeding Mr. Weitzel; C. B. HEIST, superintendent of gas measurement, transfers to the engineering department as senior gas engineer; R. L. SMITH, G. F. DOOLEY, FLOYD MOSCHEL, and O. LUCAS transfer to the engineering department; F. E. COSTANZO is corrosion engineer; R. W. WELCH is supervisor of gas management; N. P. PEIFER, chief corrosion engineer, transfers to the transmission department as transmission corrosion engineer, with JOSEPH G. KEENER as his assistant; P. N. KUZMICH, assistant chief corrosion engineer, transfers to the distribution department with the title of distribution corrosion engineer.

Recent Whirlpool Corp. appointments naming regional sales managers include CHARLES REXFORD as director of the Alabama, Georgia, Florida, Mississippi and western Tennessee region, and PAUL WERTH as head of the Ohio and West Virginia territory.

The Koppers Co. has appointed SIDNEY H. PAIGE, former personnel manager of the Tar Products division's Follansbee (W. Va.) plant, as supervisor of the industrial relations department at the Seaboard (Kearny, N. J.) plant.

M. F. Woodruff
Drake-Townsend

H. H. McMurray
Washington Gas

HERBERT H. MCMURRAY is director of sales of the Washington (D. C.) Gas Light Co., succeeding ROGER A. GORDON, who has retired. Mr. McMurray was formerly promotional sales manager.

New faces

MONTY F. WOODRUFF has joined Drake & Townsend Inc., New York, as sales engineer. He will work with utilities and industries in the design of propane plants for augmentation, standby, and 100% town or plant gas supply.

"Better get a quote from ECLIPSE"

. . . FOR FAST SERVICE ON GAS COCKS

STANDARD—Eclipse iron body brass core construction serves better, longer. Individually tested at 125 lbs. and guaranteed as to gas-tightness, accuracy and alignment of tappings.

"RETAINED KEY" — Tamperproof construction . . . offers in addition the assurance that key will not be blown from or pulled out of the body even though the lock nut is removed or the tail piece snapped off.

Both types available for immediate, partial shipment, in flat head or lock wing style, black or galvanized finish.

. . . COMPLETE STOCKS OF RIGID METER BARS

STANDARD UNION, with standard type, gasket or ground joint union. Simplify and speed setting, give maximum protection to the meter. ALSO AVAILABLE WITH INSULATED UNION.

SLEEVE UNION, with threaded, one-piece sleeve union connections . . . no gasket required. Soundness and accuracy guaranteed.

COMPRESSION TYPE has threadless connection for "stab fit" of pipe. Gives maximum protection, plus new speed, flexibility and low cost meter settings.

All types available with or without integral gas cock (standard or "retained key") in wide range of sizes and styles.

ECLIPSE FUEL ENGINEERING CO., ROCKFORD, ILLINOIS
ECLIPSE FUEL ENGINEERING CO. OF CANADA, LTD., TORONTO, ONTARIO

GAS COCKS — Eclipse — METER BARS

Write today for new Eclipse Rigid Meter Bar Bulletin, P-1; Gas Cock Bulletin, P-12.

Eclipse Fuel Engineering Co., 1109 Buchanan St., Rockford, Illinois
( ) Please send new Meter Bar Bulletin P-1
( ) Please send Gas Cock Bulletin P-12
( ) Please send samples for inspection and test.
Firm Name_____
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Classified advertising is set in 6-point type, without border or display, at the rate of 15 cents per word per insertion; minimum charge per insertion $3. Box numbers for replies count as 5 words. Count as a word each one letter word and each group of figures. Classified advertising is only accepted when payment accompanies order. Copy and payment must reach publisher's office prior to 10th of month preceding publication.

MANAGER

For large gas utility. Must have experience in conversion from manufactured gas to natural. Permanent employment. Salary commensurate with ability and experience, age, education and personal particulars. Write Box 45, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

GAS ENGINEER

Wanted by large manufactured gas utility. Excellent opportunity. Salary commensurate with ability and experience. Reply stating experience, age, education, and personal particulars to Box 410, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

SITUATION WANTED

Sales representative; college graduate; under 30; to represent gas water heater manufacturer and/or gas space heating manufacturer in Illinois and surrounding states; 5 years' experience in the gas water heater and space heating industry working with utilities, distributors and dealers. Write Box 415, GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

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MODEL AB
ONE MAN OPERATION
METAL CABINETS
HEAVY DUTY PERFORMANCE
ONLY
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FISHER RESEARCH LAB., Inc.
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stand by or year 'round

LP-GAS PLANTS

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LP Gas Installations and Anhydrous Ammonia Plants

More than 80 Peacock Plants prove . . . "There's No Substitute For Experience"

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Cathodic Protection Engineer
INSTRUCTION
6517 East 6th Street, Tulsa, Oklahoma
Phone 8-1867

JOHN W. PETERS has joined the Davey Compressor Co. as southeastern district manager in charge of air tool sales in Tennessee, Alabama, Mississippi, North and South Carolina, Georgia, and Florida.

JOHN M. COWAN has joined Vulcan Rubbert Products Inc. as sales representative. He will operate out of Norwalk, Ohio.

Transfers

HARVEY K. BRECKENRIDGE, formerly a vice president and director of West Penn Power Co., has joined Ebasco Services Inc.

HERSCHEL V. HIATT, formerly assistant chief engineer for the Allison division of General Motors, has joined the Milwaukee division of LeRoi Co. as director of engineering. He will also be chairman of the product development committee.

Steller, Millar & Lester Inc., Los Angeles, has announced the appointment of VICTOR C. HOWARD, formerly Los Angeles representative for Jenkins Publications, as account executive. He will service an important block of industrial accounts for the agency.

Deaths

ROBERT EARL FISHER, former vice president of Pacific Gas & Electric Co., San Francisco, died recently. Mr. Fisher, 72, was in charge of sales and public relations for the company.

ROBERT GROSVENOR ELY, vice president of the Connecticut Light & Power Co., died inl Farmington, Conn., late in February. Mr. Ely began his career with the Public Service Electric & Gas Co. of New Jersey. He joined Connecticut Light in 1951 as director of sales and became a vice president a year later.

JOHN MALLINSON, formerly sales manager of the Roanoke (Va.) Gas Co., died recently in Lynchburg, Va.

NORMAN F. S. RUSSELL, chairman of the board of United States Pipe & Foundry Co., Birmingham, Ala., died recently in New Jersey. He had been with the company since 1910. In 1922 he was elected vice president, in 1923 became president, and in 1948 chairman of the board.

DARWIN B. WESCOTT, 45, assistant superintendent of gas operations of the Niagara Mohawk Power Corp., Syracuse, N. Y., died recently after a long illness.

New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon on page 114 and mail, indicating by number the information or literature needed.

1 Front-end Loaders

Front end loaders in several sizes that feature torque converter, power steering, and reversing planetary transmission as standard equipment are now available from the Transo division of LeRoi Co. They range in size from ½-yd to 1½-yd capacity.

The patented bucket rocking action, which makes for fast loading in all models, and the scooping motion of the lift arms assure full bucket load within seconds without tire spinning and other undue strain on the loader. The rocking action is the result of the rocking motion of theh ydraulic cylinders, which are placed well back out of the dirt-agitating area on the machines and afford extra reach.

The FLF-150 can move to discharge points at speeds ranging up to 18 miles per hour, and because of the four-wheel drive feature, the loaders can walk through sand, mud, snow or tread with ease over rocky terrain. *LeRoi Co.*

■

2 Unit Heaters

Peerless Manufacturing Corp. is producing a new line of gas unit heaters that are claimed to be more compact, lighter in weight, and easier to service. Use of the new metal, aluminized steel, assures longer life.

These suspended heaters are built in 10 models, in sizes from 60,000 to 200,000 Btu. Each model is available with either propeller type air mover or centrifugal blower. They are built of auto-body steel, die formed,

and finished in a baked-on silver-tan. The manifold and burners are a compact unit with swing-away hinged burner pan and drop-away inspection panel on the bottom. Summer-winter switches are available for all units.

Peerless Manufacturing Corp.

■

3 Thread Compound

A new high-temperature thread compound that protects against the welding action of threaded connections subjected to prolonged exposure to extreme heat has been developed by Crane Packing Co.

The compound, Thred-Gard, is said to eliminate seizing and galling at operating temperatures up to 1200° F, is non-hardening, and acts as a lubricant to allow easy disassembly of threaded connections. Not only is dismantling time reduced, but damage to stud, bolt, pipe joint, and plug threads is said to be prevented.

By reducing wrench torque, Thred-Gard allows fittings to be drawn up to a greater degree of tightness without undue stress or strain. It is available in three sizes: ½ pint, 1 pint, and 1-quart sizes.

Crane Packing Co.

■

4 Baby Bulldozer

A baby bulldozer that can be used for backfilling trenches, clearing land, carrying (500-lb capacity), grading, and dumping is being produced by Mead Specialties Co. Called the Mighty Mouse, the earth mover is an easy-to-handle, compact machine. Its basic weight is 900 lb; length, including scoop and yoke, 81 in.

The bulldozer has a speed range of 1½ mph to 6 mph. Although special blades and attachments can be used, the scoop illustrated optionally handles carrying or bull-

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Mead Specialties Co.

■

5 Forced-Air Furnace

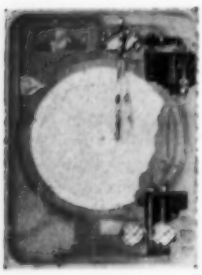
A horizontal-flow, gas-fired forced air furnace has been added to the Royal Jet line of heating equipment. The Royal horizontal utilizes any available space—in attics, under floors, in regulation basements, or in utility rooms.

The flexibility of the furnace is important where design is for a 3-in in 12-in. pitch room and under floor installations where digging a pit adds considerably to construction costs. In addition, the unit incorporates an adjustable-speed, belt-driven blower with overload protection as well as quiet operating diaphragm gas valve.

Royal Jet Inc.

■

6 Signal Transmitter



Hagan Corp. has announced that its ring balance meter is now available with a specially designed pneumatic signal transmitter that makes the instrument readily adaptable to a wide variety of remote metering and control applications, which include control installations requiring reset, remote adjustable set point, and rate action.

The transmitter is actuated by movement of the pen arm or indicator follower of the Hagan ring balance meter. These movements are transmitted to a baffle that moves about a fixed pivot to throttle air discharge from the control nozzle. Available maximum signal pressure ranges are 15, 30, and 60 psi.

Hagan Corp.

■

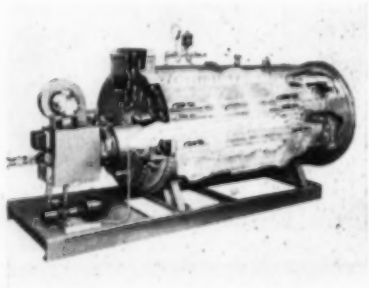
8 Zinc Anodes

Seven zinc anodes have been developed by the New Jersey Zinc Co. to meet the requirements of corrosion engineers for specific types of underground, or underwater, installations.

The new zinc anode shapes—cast of special high grade zinc—are designed to meet the great majority of known applications, such as pipeline, building and construction, water tank and marine. However, the company will work with corrosion engineers in the development of other anode designs to meet special requirements.

New Jersey Zinc Co.

■



9 Boiler

A new self-contained, fully automatic Scotch-marine boiler, capable of producing 125 hp maximum rating, has been developed by Eclipse Fuel Engineering for commercial and industrial heating and processing applications. The "Steam-boilerplant" is available with automatic controls for all operating requirements.

In addition to standard equipment, the boiler features larger than average steam space, combustion area, water storage area, and heating surface.

Eclipse Fuel Engineering Co.

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Trade Literature

10 Measuring Device Bulletin

In new illustrated descriptive bulletins, American Recording Chart Co. offers full details concerning its line of gravity measuring devices. Specific gravity instruments for use with liquids are covered in Arcco Bulletin No. 111-R2. Bulletin No. 101-R2 covers instruments for the measurement of specific gravity of gases.

American Recording Chart Co.

■

11 Heat Exchanger Bulletin

Paracoil heat exchangers are the subject of Bulletin 1000 issued by the Davis Engineering Corp. The 15-page booklet is divided into chemical, industrial, power plant, and marine heat exchanger classifications. In addition to complete descriptions and more than 50 illustrations, the bulletin includes a special section on inlustrial fuel oil heaters.

Davis Engineering Corp.

■

12 Company Catalogs

Two new catalogs are available from Eclipse Fuel Engineering Co. (When ordering copies use letter preceding description.)

(a) Catalog A-100 is on the company's gas-fired tank heater, which is used for solution heating, parts cleaning, meat, nut and potato chip cooking, wax melting, lard rendering, and water heating.

(b) Catalog F-1 describes Dowtherm vaporizers and heaters for high temperature, low pressure vapor and liquid phase process heating.

Eclipse Fuel Engineering Co.

■

13 Tractor Shovel Booklet

A booklet has been released by the Frank G. Hough Co. describing the many uses of Payloader tractor-shovels through on-the-job action photographs. Specifications of all six Payloader models are included in tabular form in the eight-page bulletin.

Frank G. Hough Co.

■

14 Annual Review

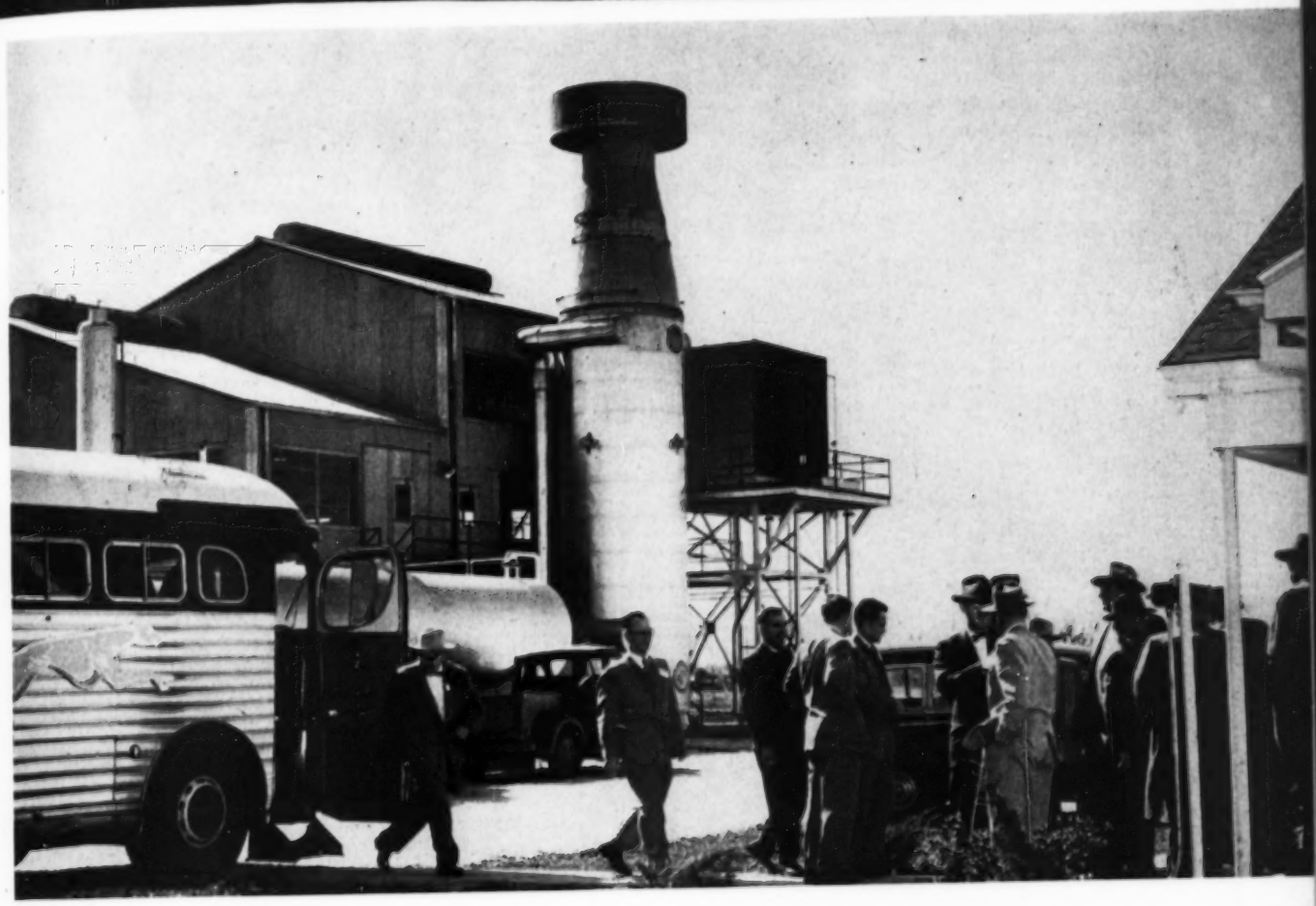
Allis-Chalmers Manufacturing Co. has released two publications. (When ordering copies use letter preceding description.)

(a) The 1953 Annual Review of engineering developments at Allis-Chalmers includes power generation and distribution, general industry, metals, national defense, stone products and coal, chemicals and petoreum, research, and operations abroad.

(b) The complete line of A-C's industrial equipment is pictorially described in the newly revised 36-page catalog "Presenting the Allis-Chalmers Line."

Allis-Chalmers Manufacturing Co.

GAS Transmission and Conditioning Section

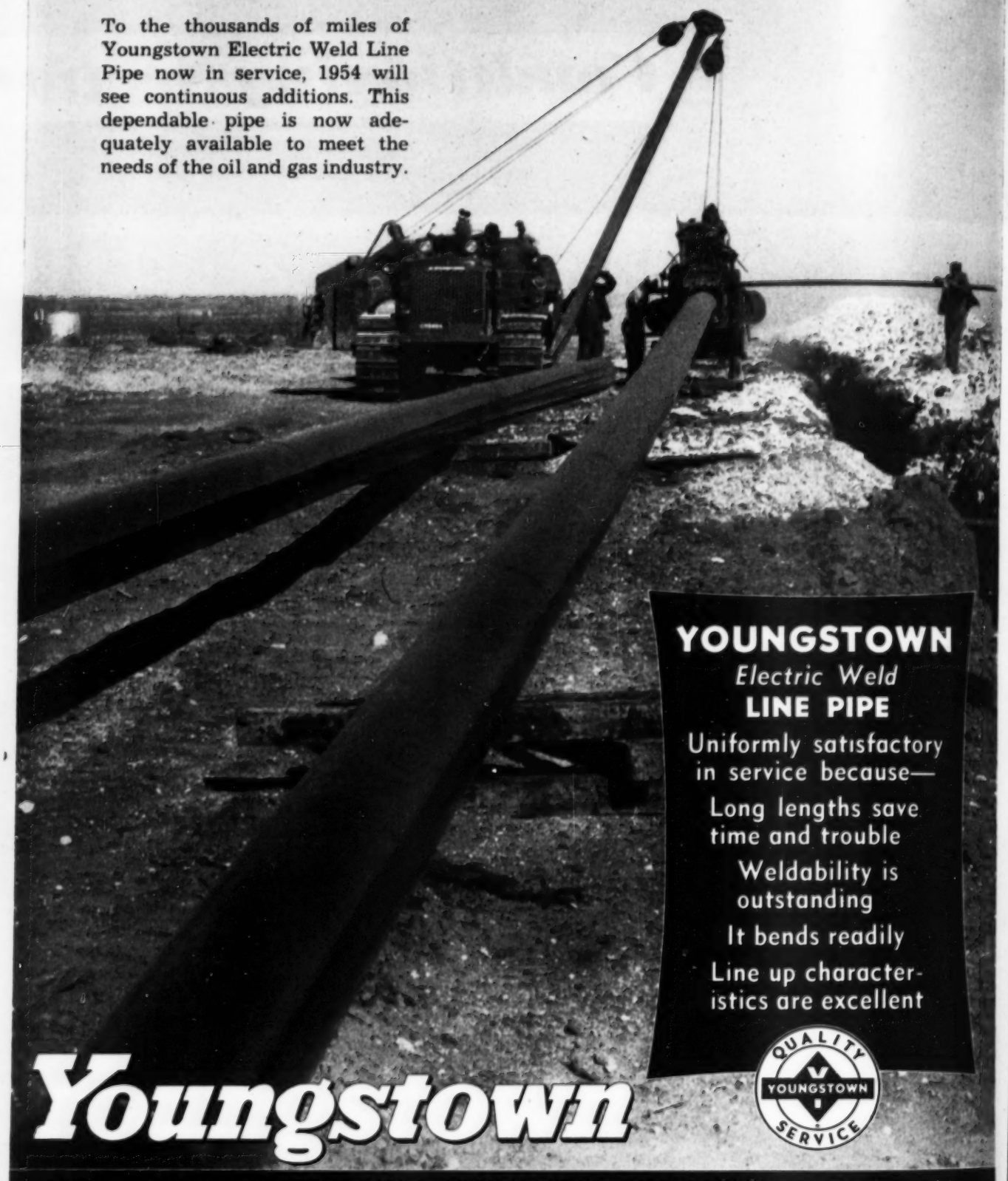


Gasmen visit United Gas Pipe Line Co's Napoleonville compressor station

Gas company men from across the country are shown as they arrived by bus at United Gas Pipe Line Co.'s new Napoleonville compressor station to tour the plant. The building that houses the turbine-driven centrifugal compressor can be seen in the background, with its regenerator and air filter. The visit to the station, which is on the company's main 30-in. line north from gas fields in south Louisiana and the Gulf of Mexico, preceded the AGA gas supply, transmission, and storage conference in New Orleans last month. *For story on the station, see page 124.*

Yes, it's Youngstown

To the thousands of miles of Youngstown Electric Weld Line Pipe now in service, 1954 will see continuous additions. This dependable pipe is now adequately available to meet the needs of the oil and gas industry.



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Gas storage in a depleted oil reservoir

By W. F. BURKE and T. W. CLAY • Lone Star Gas Co., Dallas

SEVERAL years ago, it became apparent that Lone Star Gas Co. would soon need costly additional pipeline facilities to adequately service its rapidly growing Dallas-Fort Worth market area during peak winter load conditions. As these peak load conditions existed only for short periods during each season, it appeared to be not economically feasible to construct additional large diameter pipelines from existing but somewhat distant sources of gas supply. During the same period, substantially large new sources of casinghead gas were being developed in the operating area of the company. In order to prevent material waste of this casinghead gas in the fields, it was necessary to dedicate a large portion of the company's gas market to these sources and it became apparent that the gas production from these sources might soon exceed the actual market for gas during many days of the non-heating season.

Solution: storage

The logical solution to these problems appeared to be the storage of gas produced in excess of market outlet during the non-heating season for later consumption during the relatively short winter season. An analysis of the system indicated that a considerable volume of excess gas was available during a period of approximately 200 days each year and that it would be desirable to withdraw gas from storage during no more than 50 days each year. With a desired average withdrawal rate equivalent to some four times the desired input rate, it appeared that the usual storage of gas underground in relatively shallow, low pressure reservoirs would not be adequate. Attention then was turned to deeper reservoirs which could be operated safely at much higher pressures. A number of relatively deep, solution gas-drive oil reservoirs are located in the vicinity of the major gas market area of the company. The conclusion was reached that this type reservoir when depleted would be desirable for gas storage operations, and further, that some of the energy expended in these gas storage operations probably could be used in producing oil.

A study was made of the depleted or near-depleted oil reservoirs of interest in the area, and the New York City Mississippian limestone reservoir appeared to have excellent characteristics for gas storage. The initial producing capacity of wells completed in the reservoir was unusually large and the reservoir appeared to be completely closed, offering little possibility for loss of gas through leakage. Geographically, the location of the field was desirable, being approximately five miles from one of the major gas transmission lines of the company.

The leasehold interests in the New York City field were acquired during the year 1952, and a 585-acre storage unit was subsequently formed. Well remedial work and construction of compressor and pipeline facilities were begun early in the year 1953, and gas injection was begun in August 1953.

Field history

The New York City field is located in Clay county, Texas, approximately 10 miles southeast of the town of Henrietta. The field was discovered by Shell Oil Co. in April 1941, with the completion of the E. D. Coleman "A" No. 1 well as an oil well producing from a limestone reef of Mississippian age at a depth of approximately 6100 feet. Thirteen wells subsequently were drilled in the immediate area. Ten of the wells were completed as oil wells in the reef, two wells were dry and one well, failing to find production in the reef, was completed as a relatively small volume oil well in a Strawn sand. One of the wells, originally completed in the reef, was later plugged back and produced until the start of gas storage operations from a stray conglomerate zone in the Caddo formation. Only a relatively insignificant volume of oil was produced from the Strawn and Caddo formations.

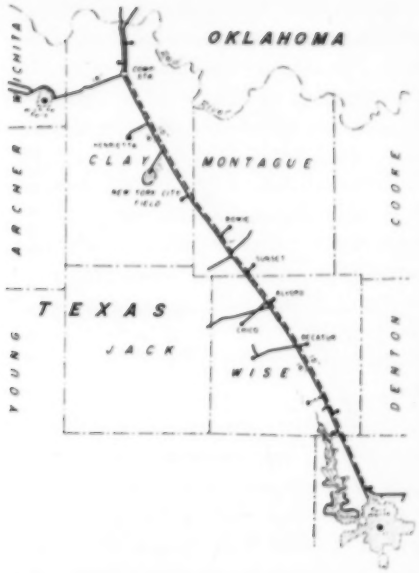

Fig. 1. Map showing location of New York City field.

Initial producing capacities of most of the wells were unusually high; the largest initial potential recorded was 10,224 bbls of oil per day. The field was abandoned in August 1950 after producing approximately 825,000 barrels of oil and an estimated 3740 MMcf of gas.

Reservoir characteristics

The New York City Mississippian limestone reef covers an area of approximately 400 acres. The reef is roughly circular in shape and attains a maximum thickness of approximately 300 ft near its geometric center. *Fig. 3* is an electric log of the reef section in one of the wells located near the center of the field. The reef is bounded by

This article has been adapted from a talk presented at the AGA gas supply, transmission and storage conference in New Orleans, March 4-5.

impermeable limestone and shale which form a completely closed reservoir. No coring was done during the development of the field and information usually obtained from core analysis and visual inspection of core samples is not available. Electric logs indicate that only approximately 50% of the total reef is composed of permeable material. The permeable zones appear to be concentrated in the upper portion of the reef, but no accurate correlation of these zones can be made from well to well.

Although no cores were available for laboratory determination of porosity and permeability values, sufficient data were collected during the productive life of the field to determine these characteristics within reasonable limits. Material balance calculations appeared to accurately reflect the volume of the reservoir, and the uniform decline in pressure throughout the field indicated good communication between wells.

Reservoir fluid

Several samples of the reservoir fluid were obtained by bottom hole sampling methods early in the life of the field and laboratory analysis of each of the samples showed essentially the same characteristics. These data along with excellent production and reservoir pressure records afforded an opportunity to study the performance of the field and predict to some extent its performance under gas storage operations.

Stock tank oil initially produced from the reservoir was of a highly volatile nature with a gravity of approximately 47° API. The initial reservoir pressure was 3120 psig. Analysis of the reservoir fluid indicated a saturation pressure of 2240 psig, a solution ratio of 970 cu ft of gas per barrel of oil at saturation pressure and a formation volume factor of 1.66 at saturation pressure. *Fig. 4* shows cumulative oil and gas production plotted against reservoir pressure and indicates the saturation pressure to be approximately 2300 psig. Accurate gas production records were maintained during most of the life of the field and the gas production during the later life of the field was estimated from periodic gas-oil ratio tests and calculations of the relative permeability of the formation to gas and oil. Gas-oil ratios began increasing at a reservoir pressure of approximately 2100 psig and at a pressure of 1500 psig the average gas-oil ratio was approximately 6200 cu ft per bbl. At a 600-psig pressure, the gas-oil ratio was approximately 15 Mcf per bbl and it is estimated that the gas-oil ratio was approximately 160 Mcf per bbl when the reservoir was abandoned at a pressure of approximately 130 psig.

Some of the wells produced a small amount of water during drill stem tests and initial production tests; however, it appears that water produced during such tests was filtration water, as no appreciable water production was recorded thereafter. No evidence of any bottom water in the reservoir was ever noted. Using an estimate for connate water of 23%, the residual oil saturation of the reservoir was calculated to be approximately 49% at the time of abandonment. Calculations show that the permeability to gas increased at a very high rate after the oil saturation was reduced below approximately 57% of the pore space and this characteristic coupled with the high shrinkage of the oil is assumed to be primarily responsible for the high gas-oil ratios during the later life of the production from the field.

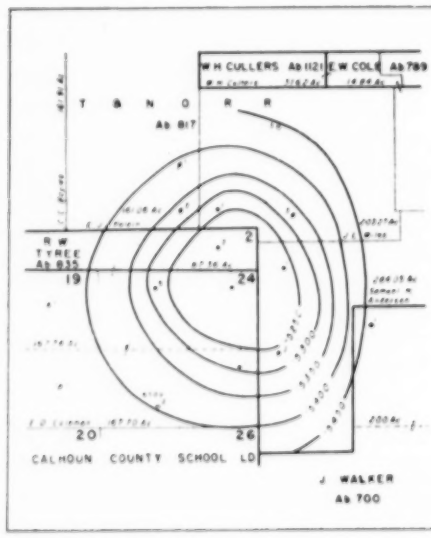

Fig. 2. Structure map contours on top of Mississippian lime.

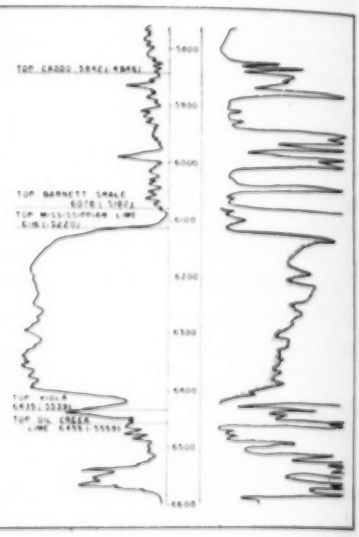

Fig. 3. Electric log of Ed. Coleman A-1 well.

Calculated volume

The reservoir volume initially occupied by oil was calculated to be approximately 9.6 million bbls and the stock tank oil initially in place was estimated to be approximately 5.9 million bbls. It was estimated that approximately 6 billion cu ft of gas could be stored in the reservoir at a pressure of 3200 psig. Sufficient information was not available for an accurate estimate of the volume of injected gas which might enter into solution with the oil and the decrease in reservoir space which could be occupied by free gas due to this effect. Even though it was realized that these factors would undoubtedly have a substantial bearing on the storage capacity of the reservoir, it appeared that an estimate of the storage capacity could be made with sufficient accuracy to permit the design of the necessary surface facilities.

Gas injection facilities

From a review of the producing capacities of the wells, it appeared that desirable gas delivery rates could be maintained from a minimum of two wells down to a reservoir pressure of approximately 1000 psig. With this in mind, two wells located in the central area of the field were selected for injection wells. It was calculated that approximately 2 billion cu ft of gas would be required as a cushion to maintain the reservoir pressure at 1000 psig and that the effective storage capacity of the reservoir between 1000 psig and 3200 psig would be approximately 4 billion cu ft of gas. The top storage pressure of 3200 psig, although slightly greater than the initial pressure, appeared to be well below the maximum safe operating pressure of the reservoir.

Using these factors, a compressor station was designed to inject an average of 20 MMcf per day at discharge pressures ranging from 1200 psig to 3200 psig. The compressor station consists of three Cooper-Bessemer (GMV)

type gas engines with a rating of 880 horsepower each. Compression is accomplished in two stages from a suction pressure of approximately 300 psig. The theoretical capacity of the station is 24,720 Mcf per day at a discharge pressure of 1200 psig and is 17,400 Mcf per day at a discharge pressure of 3200 psig.

Four wells were redrilled and recompleted in the fringe area of the reef around the central injection wells. These wells were designed primarily for producing hydrocarbon liquids and were connected to both the suction of the compressor station and to the transmission line. Separators, heaters, and a tank battery were installed near the compressor site. A separator with a working pressure of 1200 psig and a large capacity heater were installed on the gas return lines from the injection wells. In this connection, the injection wells will serve as the principal source of gas during periods when large withdrawal rates are required. Separators designed for operation at 300 to 400 psig and 50 psig were installed on the line from the fringe wells. The low stage separator is connected to the compressor fuel system and it is contemplated that all gas produced from these wells will be returned to the reservoir, delivered to the transmission line or consumed as fuel.

Fig. 5 is a map of the field area showing location of the injection wells and oil wells and the compressor station site with the field gathering and injection lines. A flow diagram of the station is shown in *Fig. 6*.

Reconditioning of wells

When the field was acquired, all but one well had been plugged and abandoned. Records outlining the plugging operations, amount of casing pulled from the wells, and location of plugs as well as other information necessary to study the condition of the abandoned holes were obtained from the former operator. Although the wells appeared to have been plugged adequately for normal circumstances, it was decided that every well which had penetrated a permeable section of the reef should be cleaned out and re-plugged as a protective measure against the proposed high pressure to which reservoir was to be subjected.

A few barrels of oil per day were being pumped from the Caddo formation above the reef in the well which had not been abandoned. This well had been completed originally in the reef and was one of the two wells scheduled for use as an injection well. The casing perforations opposite the Caddo formation were squeeze-cemented and the cement and gravel plug opposite the Mississippian reef was drilled out with cable tools. The well was completed originally from approximately 150 ft of open hole with the casing cemented near the top of the reef. After recompletion, a production test revealed that the well produced no oil but a substantial volume of low pressure gas. Gas production from this well was used for drilling fuel until the completion of a five-mile pipeline connecting the field to the nearby transmission line.

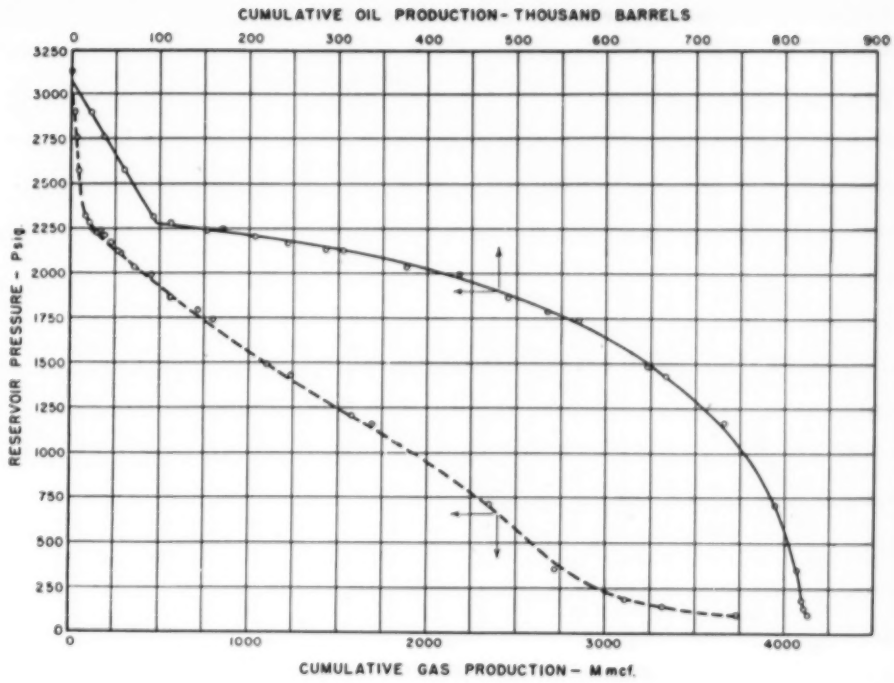

Fig. 4. Cumulative oil and gas production vs. reservoir pressure.

A number of difficult problems were encountered in cleaning out the old wells. Ten of the eleven wells with permeable sections in the reef were drilled by one operator and a slim hole-drilling program had been used on all these wells. This program consisted of drilling a 6¾-in. hole and using a 5-in. O.D. producing string of casing. When the wells were plugged the casing was shot with nitro- glycerine, with the first shot being placed at approximately 5000 ft. If the casing could not be pulled, then shots were placed successively higher until the casing came free. This resulted in a number of the wells being shot five or more times before the casing was successfully pulled. Unfortunately a number of these shots were not recorded and this, together with the condition of the pipe opposite the shot points, accounted for a large part of the difficulties in redrilling the wells. Also, as might be expected in abandoned wells, numerous articles of junk were encountered and a great deal of time was spent in fishing operations.

Holes deviated

After replugging the wells designed for use in the project, the holes were deviated beginning in each case at a point above the top of the portion of the original producing string of casing remaining in the hole and new holes were drilled from those points into the reef. A considerable saving was realized by drilling these side-tracked holes instead of drilling new holes from the surface. In recompleting the wells, 5½-in. O.D. casing was cemented into the reef and perforated opposite the permeable sections. Wells designed for producing oil were equipped with a string of two inch tubing and the injection wells were completed without the use of tubing as it was anticipated that relatively little liquid would ever be produced from these wells.

As of the date of this writing, rework operations were complete on nine wells, two of which had been redrilled as injection wells, four of which had been redrilled as liquid-producing wells and three of which had been replugged. Replugging operations are underway on the two remaining wells and it is an-

ticipated that this work will be completed within a short time.

Operation of the field

Gas injection into one well was begun in August 1953, prior to the completion of the compressor station. Tests indicated that the reservoir pressure immediately prior to injection was approximately 130 psig and initial injection was begun from the pipeline at a pressure of 285 psig without compression. Initial rate of injection at this pressure was approximately 9200 Mcf of gas per day. The compressor station was completed shortly thereafter and as of this date a net volume of approximately 1750 MMcf has been injected into the reservoir. Most of this gas was injected prior to Dec. 1, 1953. Gas has been withdrawn on several occasions from the two injection wells at rates up to approximately 45 MMcf per day and it is estimated that the present deliverability from the two wells is approximately 60 MMcf per day against a pipeline pressure of about 400 psig.

Reservoir pressure surveys were conducted in November 1953, and the average pressure was approximately 1000 psig with a net volume of approximately 1700 MMcf of gas in storage. Very little variation in pressure from well to well has been noted. Production tests were conducted recently on two of the fringe wells for a period of approximately one hour in order to obtain gas and oil samples. The wells produced a relatively small volume of 50° API gravity oil but due to the short duration of the tests no attempt was made to calculate gas-oil ratios.

One significant observation from the field operations to date is that the five wells which were completed through perforations in casing cemented through the reef have shown considerably less producing capacity than the injection well completed in the open hole section. One of the large contributing factors to this difference in capacity appears to be the plugging action of the drilling mud and lost circulation material which invaded the formation in these wells. None of these wells yet have been treated with acid in significant quantities and it is planned to acidize these wells later when the reservoir pressure has been increased.

It is contemplated that the storage cushion will be fully established at the end of the current heating season. Normal operation of the field as a storage reservoir will begin this spring and a brief outline of the proposed future operation appears to be in order. Gas injection normally will be commenced during the months of March or April after the reservoir pressure has been reduced to approximately 1000 psig by withdrawals during the winter season and injection will be continued through the month of November. As the compressor station is capable of filling the reservoir during 200 days, it is obvious that excess compressor capacity will be available during a portion of this injection period to cycle gas produced from this reservoir. In this respect, it is planned that tests will be conducted to determine the optimum operating pressure range at which oil can be produced and data now available appear to indicate that the minimum pressure for this operation is in excess of 2000 psig. Cycling of gas from the fringe wells will be started during the latter part of the annual injection period and continued as desired until the withdrawal of gas is begun. The estimated volume of gas which can be cycled for oil production during this period is approximately 500 MMcf.

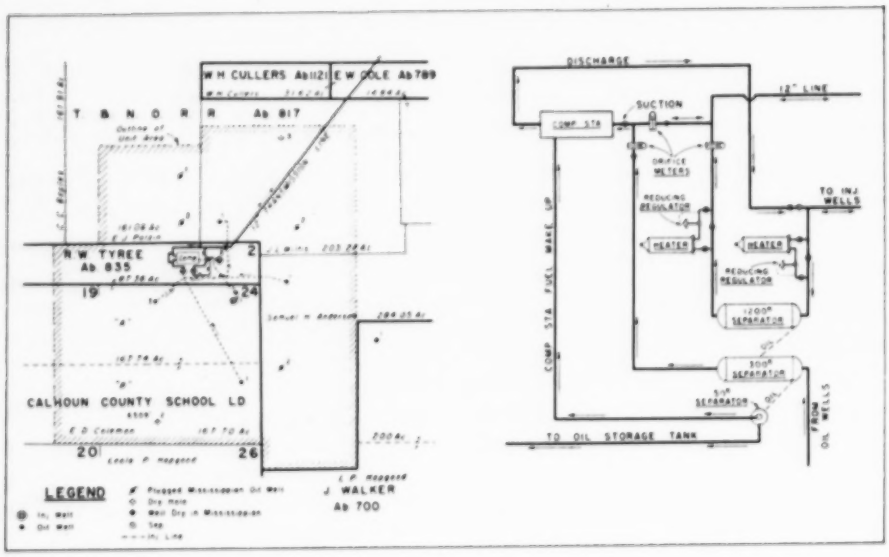

Fig. 5. Map showing field lines.

Fig. 6. Flow diagram of station.

Gas withdrawal

Withdrawal of gas from storage will begin during the month of November and continue through a part of the following March. Most of the gas withdrawn from storage will be produced from the injection wells but it is anticipated that approximately 500 MMcf of gas can be withdrawn from the oil producing wells early in the heating season while the reservoir pressure is sufficiently high to permit efficient operation of these wells. (In summary, a normal storage cycle would include injection of approximately 4 billion ft of pipeline gas during an eight months period with the compressors being utilized partially or wholly to cycle gas for oil production during the later portion of this period and withdrawal of approximately 4 billion ft during the remaining four-month period, a small portion of this withdrawal being produced from the fringe wells directly into the pipeline.

Prediction premature

A prediction of the oil recovery through this type operation would be premature; however, as of the present time it appears that oil recovery will be determined largely by the extent that the injected gas enters into solution with the oil. Performance to date appears to indicate that a substantial volume of the injected gas has entered into solution and it appears that a material volume of oil might be recovered over a long period of time. Of primary importance is the demonstration that the storage capacity is within the range of initial calculations and that the deliverability from the two injection wells is in excess of the foreseeable requirements from this storage field. The utility of the field as a gas storage facility has been demonstrated clearly and it is concluded that the expense of this entire operation is justifiable from the standpoint of this utility alone.

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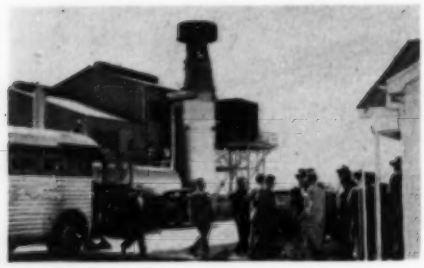


(See cover page)

Napoleonville boasts new wrinkles in station design

OCCASIONED by the annual spring meeting of the AGA gas supply, transmission and storage conference in New Orleans, about 75 gas industry men representing more than 20 companies visited United Gas Pipe Line Co.'s nearby Napoleonville compressor station as the guests of United Gas on the day preceding the opening of the conference.

The station, constructed during 1953, is on United's main 30-in. line north from gas fields in south Louisiana and the Gulf of Mexico. Because of a number of relatively new features incorporated in the design of the station, it has been termed one of the most modern in the country.

The station is powered with a 5700-hp General Electric gas turbine that drives a DeLaval centrifugal compressor. Although the turbine is rated at 5700 hp at 5000 rpm, its speed can be adjusted from 2000 to 5500 rpm, a relatively new feature in the design of centrifugal compressor stations. The compressor has a capacity of 575 MMcf per day from 795 psig to 925 psig for a compression ratio of 1.16.

All controls for starting, operating, and stopping the turbine and for regulating station pressures are located in the control room, which is separated from the main engine room by a solid wall fitted with vapor proof glass panels. Station suction and discharge valves and the mainline valves can be push-button controlled from the control room. Remote control operation of the various valves is by E-I-M valve operators actuated by gas from the pipeline and electrically controlled by power from station batteries.

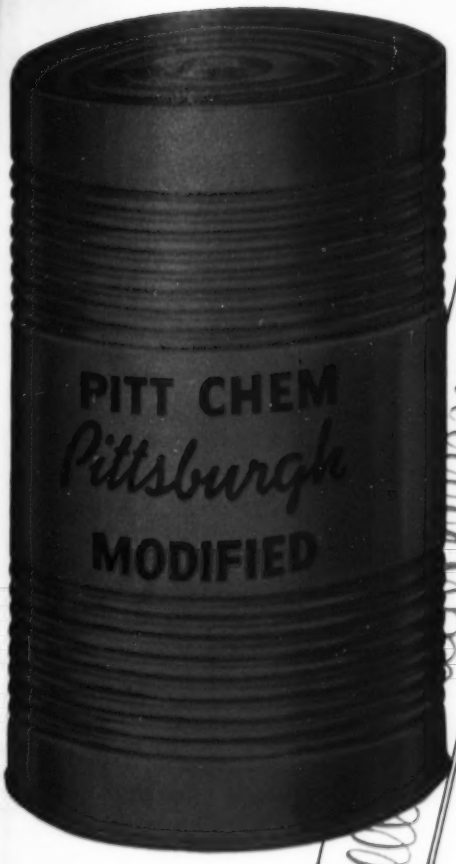
Put into operation on Nov. 7, 1953, the station has already been instrumental in enabling United to surpass its all time peak day delivery. On Monday, Dec. 14, when United Gas became the first and only pipeline company ever to deliver 4 billion cu ft of natural gas in a single day, dispatching sheets showed that more than ½ billion cu ft of the record total has been pushed through the 30-in. by the new centrifugal booster station. Although the actual load through Napoleonville on that day was 510,992 Mcf, since then it has handled as much as 575 MMcf in a single 24-hour day.

Construction of the station was started in the spring of 1953. United Gas Pipe Line Co. did the design and engineering of the complete station. It is, among other things, the first pipeline station powered by a GE gas turbine where electric power for auxiliaries is not provided by generators gear-driven from the main unit. In this instance electric power is purchased and standby gas engines are provided in the event that purchased power is interrupted for some reason.

Because of the low load-bearing soil in the area of Napoleonville, the station was built on 130-ft piles. The mat and foundation are such that any settling of either will not result in turbine-compressor misalignment.

Shown in front of the Napoleonville station control panel are (l to r): J. B. Storey, M. M. Heller, and H. W. Egger, all of United; and J. S. Quill, of General Electric. Mr. Egger was host to the group that visited the station.

R. A. Toups, United Gas Pipe Line Co. (right), shows B. C. White, of Stone & Webster (left), and M. N. Day, Michigan Consolidated Gas Co., around United's new turbine-driven centrifugal compressor station at Napoleonville, La.



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Specific gravity, A.S.T.M. D-71	1.40-1.50
Softening point, A.S.T.M. D-36	190-200°F.
Penetration, A.S.T.M. D-5 100 g., 5 sec., 77°F.	2-6
Ash, A.S.T.M. D-271	20-25%
Sag test, 7 hrs.	no sag at 140°F.
Cold cracking test, 5 hrs.	no cracking or disbonding at 0°F.
Peel test	no peel at any temperature from 0° to 140°F.
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Dispatching gas through interconnected pipelines

By **CARL T. KALLINA** · Federal Power Commission

IN its 1952 Annual Report to the Congress of the United States, the FPC made certain "Legislative Recommendations." Two of these clearly point out the attitude of the commission itself toward the desirability of emergency interconnections.

"(1) *Natural Gas Act—Emergency Interconnections* — It is recommended that a new subsection (i) be added to Section 7 of the Natural Gas Act giving authority to the commission, similar to that conferred by Section 202 of the Federal Power Act, to require natural gas companies to interconnect their facilities with others engaged in the sale and distribution of natural gas and to sell or exchange gas with such persons, together with authority to prescribe the terms, arrangements, and conditions for such interconnections and the compensation payable therefor.

"(2) *Natural Gas Act—Voluntary Interconnections* — It is recommended that a new subsection (j) be added to Section 7 of the Natural Gas Act permitting voluntary interconnections of natural-gas facilities and their maintenance on a permanent basis for emergency use upon authorization by the commission, and under such circumstances conferring a jurisdictional exemption. Such a provision is now contained in Section 202 (d) of the Federal Power Act."

Before getting specific, it should be explained that the use of the term "emergency" in my discussion is not limited to the strict sense of the word implying only unforeseen circumstances requiring immediate action, such as a line break or other physical failure. "Emergency" herein is also used as implying measures for taking advantage of unforeseen economic benefits and, most important, as a part of a general plan of cooperative operation for meeting situations involving expected but extraordinary circumstances.

This article is adapted from a talk presented at the AGA gas supply transmission and storage conference held in New Orleans, March 4-5.

Let us concentrate initially on the present conditions in the industry. Prices are on the rise both in cost of new gas purchased as well as in construction and operation of pipelines, and market demands generally exceed the ability of the industry fully to meet all demands.

Emergency interconnections

Accordingly, situations in which the existence of emergency interconnections are desirable may be summarized as follows:

(1) *To maintain service during a line break or other unforeseen physical interruption of facilities.*

The nightmares of gas distributing companies are bound to include as a feature attraction the probability of consumer outages due to discontinuance of supply. Every distribution system of consequence takes every precaution to design and operate its system so that in the event of an accident, it can physically rearrange its operations promptly and minimize the number of consumers shut off. For this reason alone, it appears incumbent on pipeliners to take every reasonable measure necessary to provide connections wherever feasible in order that interruption in pipeline supply be minimized to the fullest extent possible.

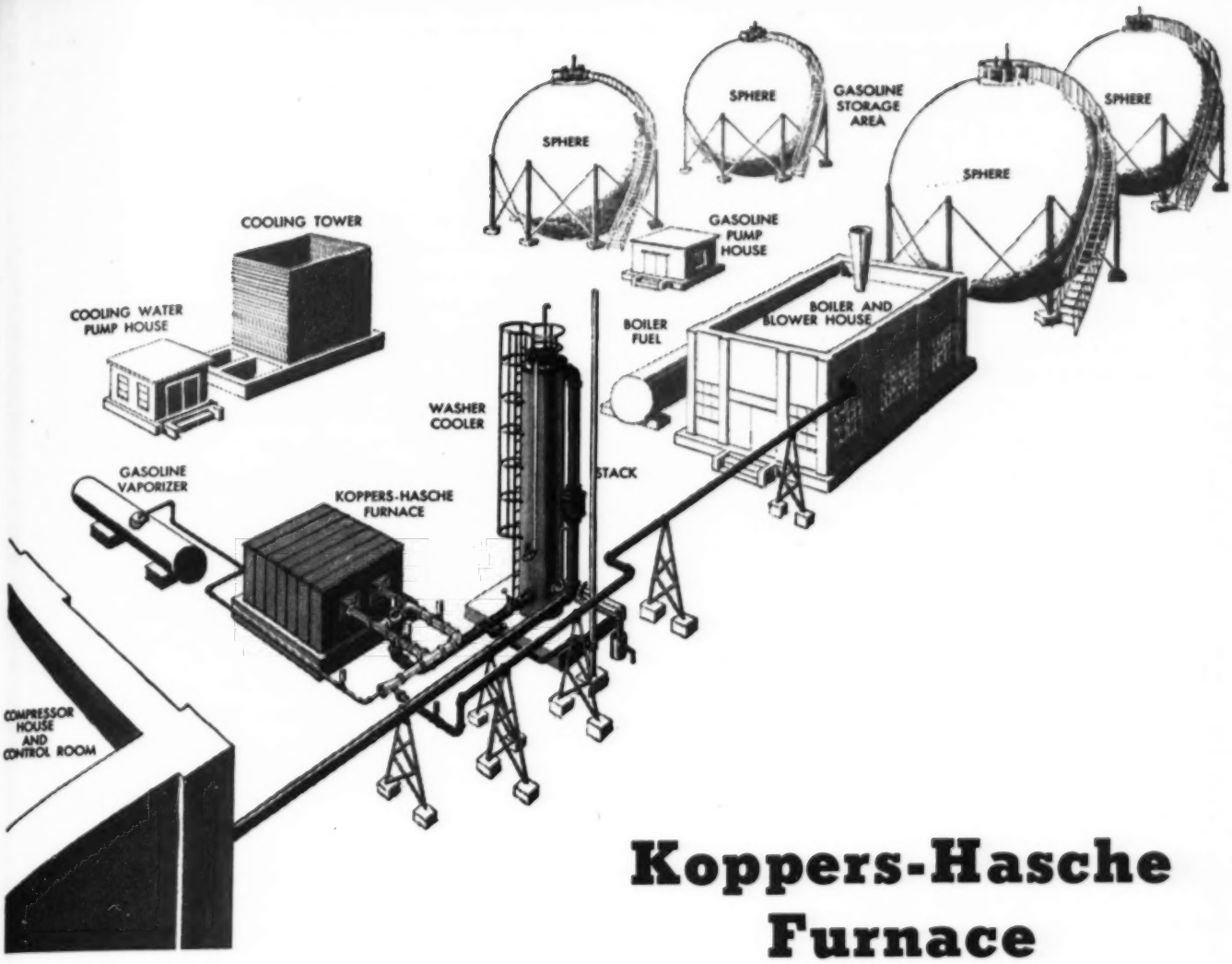
Consideration of the possibilities of connections to provide the safeguards against outages should not be confined to the simple project of adjacent lines of two companies where pressure conditions and other operating factors are such as to make it readily possible for one to deliver gas to the other with only the opening of a valve. Situations prevail where only one of two adjacent lines can physically deliver gas to the other. The return of such gas may possibly be more practicable at another location where operations are compatible to effect either the return or the initial delivery of gas in the event of an emergency on the other line.

The use of such arrangements has proven feasible in many cases. One specific example involves a series of interconnections between two companies where emergency deliveries at the eastern end are returned in the southwestern producing areas, as circumstances dictate, to the advantage of both. Furthermore, deliveries and return of emergency gas need not be made directly by physical connection between the participating companies. Many emergencies, particularly during the war years, were successfully reduced by so-called displacement. That is, third and even fourth or fifth parties having mutual operations in an area can exchange gas by having the company with gas available take on a part or all of an obligation of the company in trouble with the latter cutting back on its normal obligation. My description of such arrangements is not nearly as complex as the details of actually working out such plans. To bring them about when the emergency is upon you is most difficult unless prior planning is made so that dispatchers and other operating personnel are prepared and necessary legal procedures, such as regulatory approvals and contracts, have been taken care of in advance.

(2) *Emergency connections are desirable to physically and most economically maintain adequate supplies of gas from producing areas.*

Conservation of the nation's natural gas resources is of paramount interest today. Situations may exist whereby the production in a given area is insufficient to maintain normal operations. On the other hand, the production available may also be in excess of pipeline requirement elsewhere. The solution here is obvious, the first company by exchange arrangement makes up its deficiency while the second is able to satisfy its producers and maintain rateable takes.

Conservation measures have substantially reduced the waste created by flaring of gas. There is still a substantial volume of gas being flared. The figures for Texas during the month of September 1953 alone were in excess of 20 billion ft. Certainly, with careful planning and the use of interconnections including multi-company displacement, further substantial reductions in this wastefulness should be afforded. The feasibility of such programs has been enhanced many fold in



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the past decade by virtue of the substantial growth of underground storage programs.

About the only limitation on the ability to take excess flare gas is pipeline capacity, which could almost miraculously be found through careful planning of interconnections and displacements. That is not an idle dream; actual cases can be cited in which, through such interconnections and displacements, substantial volumes of gas were made available for storage and other uses at locations remote from the original source. Such gas sold to the storage company for its own use or stored for the account of other companies, as will be discussed more fully hereinafter, is another reason why interconnections require proper planning.

"Spot purchase" gas is usually attractive to a pipeline company because of its lower cost. Unfortunately, "spot" gas may be available to the most convenient pipeline at times when it cannot be utilized. It is readily conceivable, however, that more of that gas could, by the routes described herein, find its way to market or storage.

Contract provisions

We know that many long-term gas purchase contracts with producers contain provisions whereby payment must be made for specified volumes whether or not taken, the so-called "minimum or take or pay for 'provisions.'" True, there is usually a credit built up for gas not taken but paid for providing the gas is taken in a reasonable period of time. This situation, however, may create a serious obstacle in further negotiations for gas supplies and, on occasion, has worked to the disadvantage of companies with programs for expansion because further expansion requires more gas reserves and there is an economic limit beyond which a company cannot commit itself as to the payment for gas which may not be taken.

Surely, temporary emergency measures (and I consider this latter illustration an economic emergency) can be taken to alleviate these problems. Here again, I know from actual experiences in participating at the regulatory end in such arangements, this situation has occurred and been met most satisfactorily.

(3) *Interconnections are proving invaluable in maintaining high capacity operation.*

It is axiomatic that the higher the rate of capacity utilized, the lower the unit cost. High capacity operation has been achieved with success by disposition of gas on an interruptible basis. The weakness of this treatment has always been the fact that increased firm demand requires increased firm capacity with a corresponding increase in volumes available for sale on a non-firm basis. Higher costs of construction and of purchased gas are creating a further problem where, because of these price factors, the increase in capacity is not economically justified and non-firm gas cannot readily be sold at a satisfactory profit. The solution to this problem would be interconnection between pipelines coupled with greater utilization of underground storage.

Arrangements of this type have already been effected and several others are in various stages of process. A pipeline having its own storage reservoir can meet continued growth of firm market by injection of off-peak gas into storage for peak requirements. Incremental pipeline capacity construction may thus be materially reduced and revenues obtained for the gas theretofore dumped should be more compensatory.

This condition is not, however, as simple as it sounds. In the first place, all pipelines do not have their own facilities where needed. Secondly, gas is required to develop a storage program. To meet the first problem, cooperative arrangements between pipeline companies and storage owners have resulted, by one means or another, in making available storage space to those otherwise not so blessed. To fill these pools with gas quickly then becomes the main problem. The storage owner and the participating pipeline company are not always able to meet the storage gas requirements from existing sources. The problem then is: shall they increase mainline capacity for this purpose or is there another and better method available.

A better method may be available; viz, the utilization of interconnections. Other pipelines having surplus off-peak capacity by direct sales through interconnections and displacements may be prime sources for the necessary gas. Another procedure is the relatively new practice whereby pipelines maintain high load factors on their sales by having excess firm gas stored for the account of customers subject to redelivery as needed. The delivery and redelivery is executed primarily through displacement minimizing to a considerable extent construction of additional transmission pipeline facilities for storage operation.

(4) *Pipelines should be designed with emergency interconnections.*

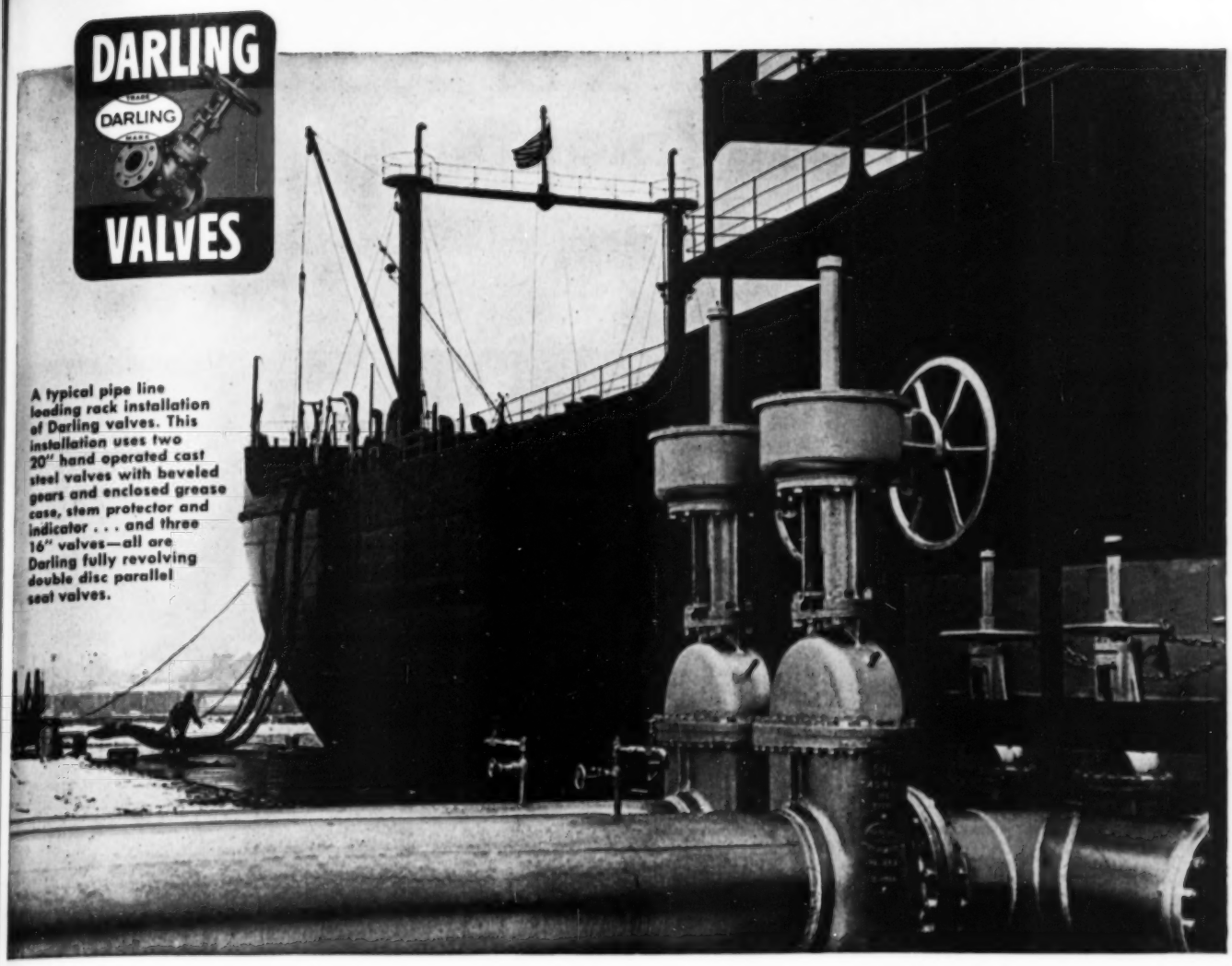
Having already touched upon the possibilities of savings in investment and operation by avoiding capacity construction to meet additional requirement, it is not inconceivable that initial design should also include similar plans. I know of no initial construction program which has included, as a part thereof, thorough coordination of operations with other pipelines. It does not make sense for two or more pipelines starting from the same area, or in part traversing the same area, or serving the same area each to go to the expense of duplicating facilities. No individual company would duplicate its own facilities unnecessarily and there appears to be no sound reason for neighbors not to avoid duplications in facilities among themselves. Thought should be given to the probability of providing further economy in pipeline construction by means of staggered installations; that is, one system installs capacity one year and the other the next so that during the two or three year period when loads are being developed, particularly in new areas, higher utilization and less expenditure on the combined operations may be possible.

Numerous possibilities

There are any number of possibilities which can be achieved by sound engineering design.

(5) *Interconnections are vital to the National Defense.*

None of us who participated in the hectic sessions of defense agencies in World War II, and the less hectic but nonetheless serious sessions during the Korean crisis, wants to renew those activities. It may be said here, as it has before, that the cooperative attitude of the gas industry as a whole in meeting national emergency problems was exemplary. Surely, preplanning for the maintenance of adequate service to installations vital to our national security needs no justification. All of the previous economic advantages discussed herein should be considered when planning for national defense. Conversely, when consideration is given to interconnections for economic purposes, the national defense possibilities should not be overlooked.



A typical pipe line loading rack installation of Darling valves. This installation uses two 20" hand operated cast steel valves with beveled gears and enclosed grease case, stem protector and indicator . . . and three 16" valves—all are Darling fully revolving double disc parallel seat valves.

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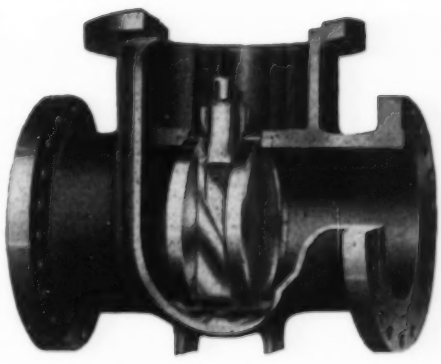

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The economics of packaged compressor plants

By E. S. McROBERTS • The J. B. Beaird Co., Shreveport

IF YOU were to take an entire compressor station of a major pipeline, with its compressor, cooling equipment, lubricating system—all its manifolds, piping, scrubber and starting air system—assemble these in a factory on a rigid fabricated steel base—add a number of additional automatic safety controls—you would have a real packaged compressor plant.

It would also include not only all these parts and components, but it would have behind it a careful job of engineering—both mechanical engineering and process engineering. For in a packaged compressor plant, proper design, layout and sizing of parts is as essential as it is in a large stationary compressor station.

Complete packaging is a great deal more than just skid mounting or packaging a compressor—it is packaging an entire plant. Even though it is wholly complete and fully assembled, it must be so compact in design that it can be transported by oil field trucks directly to the installation site. And it must be so ruggedly built that it will require little attention and stay in service for a life time. We refer here only to heavy duty, direct connected, gas engine-driven compressor plants.

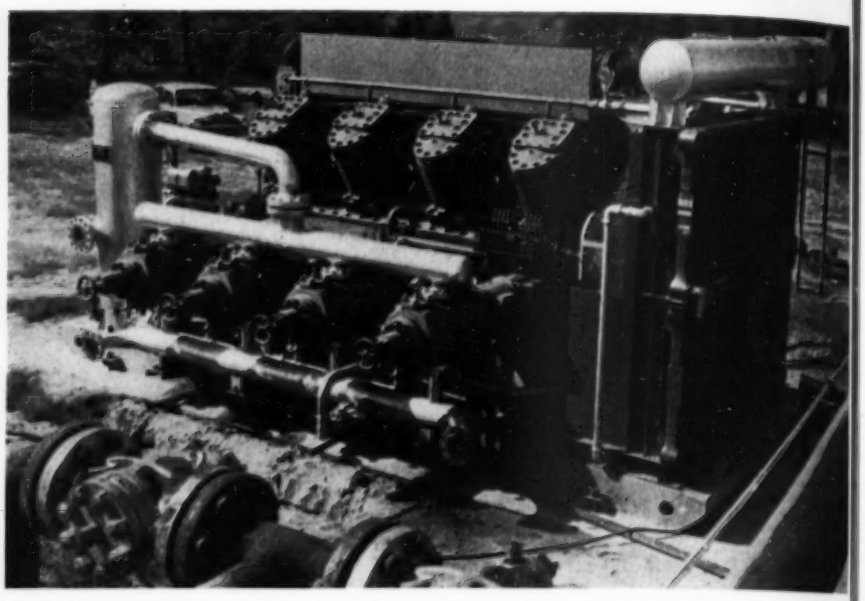
These packaged plants have a variety of applications in oil and gas production as well as in other fields. For each one is individually designed and may be adapted to any use where gases or air must be compressed.

Let's take a look at a few of these applications. In the production of oil, wells eventually lose their pressure and require artificial means of lifting oil from the formation to the surface. A number of years ago it was discovered that this could be done by what is known as "gas lift," using residue gas from the field to literally push the oil up out of the hole. If the gas pressure was not sufficient, however, a compressor plant had to be installed to make gas lift possible.

Today, with the development of special gas lift valves and the packaged compressor plant, this method of production is gaining in favor. It is proving especially popular in areas where wells are deep. When you try to pump oil out of a deep well, you have a great loss of pump efficiency, because the sucker rods stretch and sometimes the amount of the stretch is almost the stroke of the pumping unit.

Another very important use of the packaged compressor plant is in the saving of flush production gas from new oil wells. Most state regulatory bodies will allow increased oil production if this gas can be saved. If there is a gasline available nearby, it can be compressed to line pressure and sold. Otherwise, it can be pumped back into the reservoir to maintain pressure and prolong the flowing life of the field. Increased allowables mean increased income for the oil producer and the packaged compressor plant under these circumstances will usually pay for itself in a very short length of time.

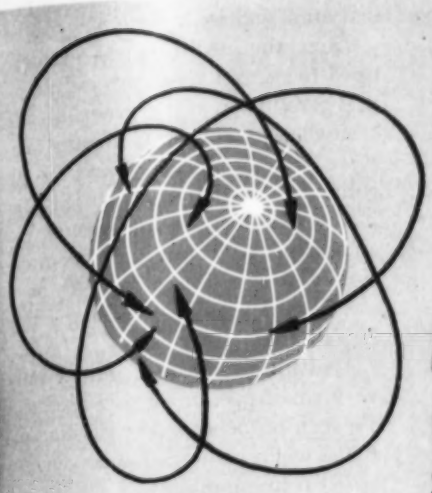
But the packaged plant has found its greatest use so far in the production of gas. As gas gathering systems have reached farther and farther into new

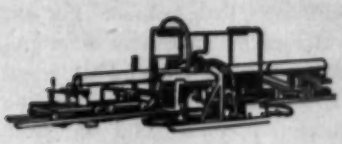


This 440-hp unit is shown on location as it arrived from the Beaird factory. It has been grouted in on a simple slab foundation and only a few connections are required to put it on stream.

Before becoming manager of sales of packaged compressor plants at J. B. Beaird Co., Mr. McRoberts, with the company for 10 years, had been assistant chief engineer. In that capacity he was largely responsible for original development of the packaged compressor plant. Among his professional affiliations are the Louisiana Engineering Society, American Ordnance Association, the API, the State Board of Registrations for Professional Mechanical Engineers, and the Dallas Engineers Club.

This article has been adapted from a talk presented at a recent ASME petroleum mechanical engineering conference.





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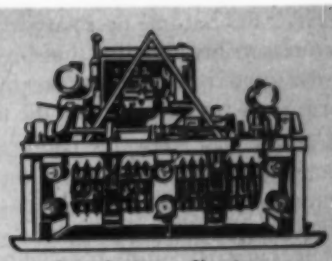

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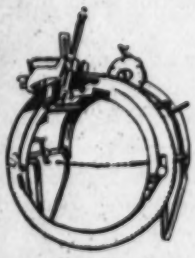

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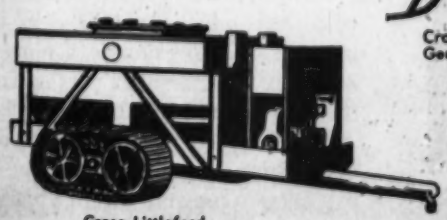
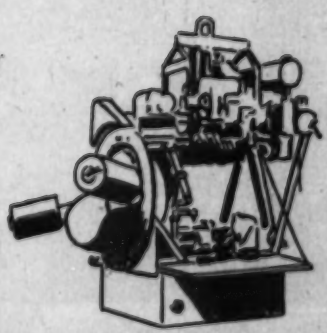
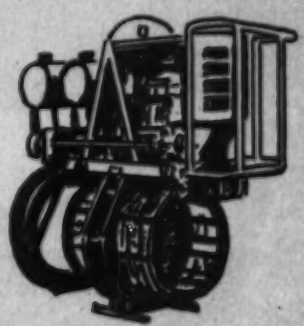
Crose Self Propelled Generator



Crose Littleford Pipeline Kettle



Crose Line Traveling Coating And Wrapping Machine



Crose Line Traveling Cleaning And Priming Machine

fields, it has become necessary to maintain reasonably high line pressures, and, at the same time, keep gas flowing into these lines from all wells in the fields.

When field pressures begin to fall, some wells will not flow into the gathering lines at all. Others will have their flow sharply reduced. Usually these wells are fairly well grouped so that two or three or even more may be tied into one field compressor and the gas compressed to pipeline pressure.

This is far more economical than lowering line pressures in the field and installing compressors in the gasoline plant. In this event, all of the gas from the field must be compressed, while only a small part—say 10%—may actually require it.

If a compressor were centrally located at the plant to handle an entire field, it would also be necessary to install a new field gathering system. For example, a line designed to carry a given volume of gas at 1400 or 1500 psi would handle a far smaller volume at 200 or 300 psi.

There would also be a saving in the compressor installation itself by using smaller field compressors located near the wells. Less overall horsepower would be required to deplete the field, because as the first wells requiring compression are depleted, the packaged compressor plants can be moved to other locations in the same field and reused. I believe that this one feature would result in a saving estimated conservatively at 25% and possibly more.

Another economy of the packaged compressor plant in gas boosting is its ability to handle varying load conditions with very little change. For example, the plant is usually a single-stage unit when installed. That is, all of its compressor cylinders have the same suction pressures and the same discharge pressures.

These cylinders are sized to permit operations at a suction pressure equal to or slightly less than the discharge pressure, but large enough to permit operation until the suction pressure has declined to such a point that single-stage compression can no longer be used efficiently.

When this time arrives the change to two-stage compression can be made by adding one or, at the most, two new cylinders for the first stage, installing a gas intercooling coil on the radiator, and mounting a second-stage scrubber. The cost of such a changeover is held to a minimum because, in the basic design, provision had been made to accommodate this equipment. With the exception of the new compression cylinders, the cost will be no greater than if it had originally been purchased as a two-stage plant.

In the conservation of natural gas, the packaged compressor plant has played a large part. Not too many years ago gas was considered a necessary evil in the production of oil, to be separated from the crude oil the best way possible and disposed of by burning because some of it had a bad habit of settling in low places where it was likely to explode when some unsuspecting person struck a match. Now we know that the part that settled out was the butane or propane fraction, which has a specific gravity greater than air.

During this time, especially in isolated areas, gas wells were plugged.

Later, the gasoline plant was developed to recover from wet gas the natural gasoline or, as it is generally called, casinghead gasoline. Gathering lines were laid into fields where the gpm content was relatively high. Separator gas was brought to the gasoline plant and stripped. The residue gas was returned to the leases for fuel or any other local uses for which gas might be required.

Usually, producers required only a very small portion of this residue gas for such purposes, so the gasoline plant flared what was left. The producer was paid on the gpm only.

Today, with the packaged compressor plant in use, this residue gas may be utilized for gas lift, repressuring, or for delivery into the gathering system of a gas transmission line.

Just as packaged compressor plants lend themselves to oil and gas production, they have proven their value on other fields as well. They have been installed in industries for compressing large volumes of compressed air or for refrigeration. Installations have varied from small single units to multi-unit banks of the large 550-hp units.

In any installation, approximately the same requirements are required for refrigeration or compressing air as are required for compressing gas. In industries as well as in remote gas fields the economics of complete packaging have effected material savings in installation and operation.

We have discussed the economics of complete packaging. Now let's take a look at the reasons why packaging saves on both installation costs and operational costs.

While there are a number of standard size packaged compressor plants on the market, the standardization is only on the power end. The compression end is a custom-designed job. Each one must be engineered specifically for the job it has to do.

This does not mean that we would take one suction and one discharge pressure and design a plant for this job alone. It means that we would take a look into the future and determine what the conditions will be as the years progress. As an example, assume that we are asked to design a packaged compressor plant to pick up gas at 800 psig and discharge at 1000 psig. After some questioning we determine that the 800-psig suction pressure will in a few years time have dropped to 400 psig. This means that we must design all of the

These two packaged compressor plants supply gas at required pressure to produce 46 oil wells near Falls City, Texas. This one station eliminates the necessity for installing many pumping units all over the field.

held to a minimum.

Table 1 tabulates the actual costs, completely installed, of a 3300-hp plant, comprised of six 550-hp compressors. This table shows that the completely installed cost is $176 per horsepower. To those of you who have had experience with the permanent type installation of compressor stations, this will no doubt seem to be a very low figure, for you would normally expect this cost to run from $250 to $300 per horsepower. However, the figures here speak for themselves and are taken from an actual bid. I would like to point out, however, that to get these low figures it is absolutely imperative that the plant be completely designed and every piece be fabricated in the plant or factory and installed on the base before shipment to the job. For every item of work that has to be done in the field, the cost goes up.

We have spoken earlier of the low operational cost to be expected from the packaged-type installation; *Table 2* shows a comparison between an installation of packaged compressor plants and a permanent type station. Column 1 shows the actual operation and maintenance costs of a 1200-hp packaged compressor plant consisting of four 300-hp units for a period of 11 months. You will note that the operating cost per brake horsepower per year is $13.50 and that the maintenance cost per brake horsepower per year is $2.50, making a total of $16. Column 2 shows the actual operating and maintenance costs of a 4000-hp permanently installed compressor station and covers an operating period of 12 months. The operating cost per brake horsepower per year is $17.70 and the maintenance cost per brake horsepower per year is $2.90, making a total of $20.60. Here, again, the figures speak for themselves. Needless to say, this operator uses the packaged compressor plant wherever possible in his operations.

These figures serve to emphasize one of the most important points of this discussion: The low first cost should not be obtained by sacrificing either completeness or quality. For any given job a definite amount of equipment is required.

It is more economical to purchase this equipment as a part of the packaged compressor plant than to purchase these parts individually and have them installed in the field.

It is possible to effect a considerable reduction in the first cost by lowering the quality of this equipment. Any re-

TABLE 1. COST ESTIMATE

(A 3300-hp installation of packaged compressor plants)

Quantity	Item	Material	Labor	Total
6	550-hp packaged compressors	$483,000	—	$483,000
	Freight	3,420	—	3,420
	Handling charge	—	2,100	2,100
	Foundation and floor	3,700	7,350	11,050
	Grouting	—	540	540
	Building	7,510	1,600	9,110
	Electrical	860	700	1,560
	Paint	100	600	700
	Miscellaneous piping	3,120	2,000	5,120
	Gas measuring and regulation equipment	3,000	1,800	4,800
	Miscellaneous labor-erection	—	5,070	5,070
	Headers:			
	Suction	3,549	2,350	5,899
	Discharge	8,452	11,412	19,862
	Fencing	1,440	540	1,980
	Land (four acres)	5,000	—	5,000
	Grading and drainage	2,600	—	2,600
	Engineering and design	—	1,250	1,250
	Office building	1,200	800	2,000
	Furniture-office building	1,300	200	1,500
	Sub-totals (less compressor costs)	$ 45,249	$38,312	
	Purchase costs and insurance	2,262	6,130	8,392
	Contractor's fee:			
	Tools			
	Overhead			
	Supervision			
	Profit			
	Supplies			
	Adding compressor costs	483,000	6,513	6,513
	Grand Total	**$530,511**	**$50,955**	**$581,466**

(Based on 3300 hp—cost per hp—$176)

TABLE 2. OPERATING AND MAINTENANCE COST COMPARISON

(Actual cost records from one of the largest gas companies in the U. S.)

	No. 1*	No. 2*
Brake horsepower hours operated	2,223,511	22,598,793
Operating labor cost	$ 7,393	$36,699
Fuel cost at 5c per Mcf	2,523	12,655
Lube oil at 60c per gal	2,393	4,127
Other supplies	439	418
Automotive	8	446
Other expenses	587	2,702
Electric power	279	7,182
Overhead expense	1,230	6,612
Sub-total	$14,852	$70,841
Operating cost per brake horsepower per year	$13.50	$17.70
Maintenance		
Labor	$ 792	$ 5,445
Material and supplies	1,385	3,505
Automotive	—	401
Other expenses	475	1,548
Overhead	110	694
Total	$17,614	$82,434
Maintenance cost per horsepower per year	$2.50	$2.90
Total operating and maintenance cost per brake horsepower per year	$16.00	$20.60

*No. 1 is a 1200-hp packaged type compressor station semi-manned. Operating period is 11 months.

*No. 2 is a 4000-hp fully manned station using two men per shift with relief crew (approximately 15 men). Operating period is 12 months.

Bubbling on surface of Senacaville lake indicates leak in line that lies in 16 ft of water.

Diver spends seven cold minutes in lake to repair Ohio Fuel leak

SEVEN endless minutes, a professional deep sea diver and a crew of rugged linesmen—that's what it took to repair an Ohio Fuel Gas Co. pipeline on the bottom of Senacaville lake in weather only 1° above freezing.

It all started when Ohio Fuel inspectors spotted a leak in the gas main that feeds Quaker City, Bethesda, and Barnesville. It was about 300 ft from shore on the northwest section of the lake.

Norman E. Staley, a professional diver from Templeton, Pa., was contacted. Ohio Fuel crews from Cambridge and Barnesville met him at the nearby lake to assemble his diving barge.

Among them were W. E. Beale, Ohio Fuel's southeast division superintendent; Ross Mitchell, district foreman; James F. Parks, Robert Savage, Everett Campbell, James Upton, Clarence Orr, Bill Douglas, Dale Davis, and Ed DeVolld.

Guests of wind up to 30 miles an hour had churned ice from the lake surface into pieces no larger than icec ubes. The barge was nearly swept away by the wind on the first try at launching. Four anchors were used to hold it in place.

Diver Staley examines pit-hole saddle patch that he will have to use to repair leak.

An air pump, used to supply oxygen to the diver, froze. Ohio Fuel crews used an auxiliary hand pump. Even then there was danger that moisture in airlines might freeze and cut off the supply of air to the diver.

At 12:08 pm the diver slipped into the water. Muck from the bottom of the lake prevented him from seeing. He had to "feel" for the leak in the pipe.

"It's only a small hole," he called over the two-way telephone unit.

The patch, a "pit-hole saddle" with a rubber gasket, was quickly lowered to the diver, along with a wrench. The saddle would seal a band of rubber and steel around the pipe when it was tightened.

The boat crew waited. Then they heard the diver singing over the telephone.

Minutes ticked by as the wind whistled around a protective piece of canvas on the barge. Suddenly the telephone quit. Deck crews pumped frantically to make sure Diver Staley had air.

Then the bubbling in the lake stopped, the phone started working again, and Ohio Fuel deckhands heard Diver Staley say: "She's okay now. I'm coming up."

At 12:15 pm his diving helmet appeared and hew as hoisted onto the barge. Weak from cold and exhaustion the 38-year-old diver almost tumbled back into the frigid water. Crew members pulled him to safety.

On Ohio Fuel's records this was jotted down: "Leak repaired. No interruption of service."

duction made by this means, however, will be offset by higher maintenance costs and these higher costs are with you as long as you operate the equipment. Along with the expense of replacing parts that have worn out, do not overlook the fact that you are *not compressing gas while the mechanic is at work*. The cost of lost production does not show in an operating and maintenance statement but, in my opinion, it should be included.

The manufacturers of ball and roller bearings have established a life factor for their product. The purchaser can select a bearing for his particular application with reasonable assurance that it will have a definite operating life. While compressors are not sold on this basis, the fact remains that the same limiting factors are there.

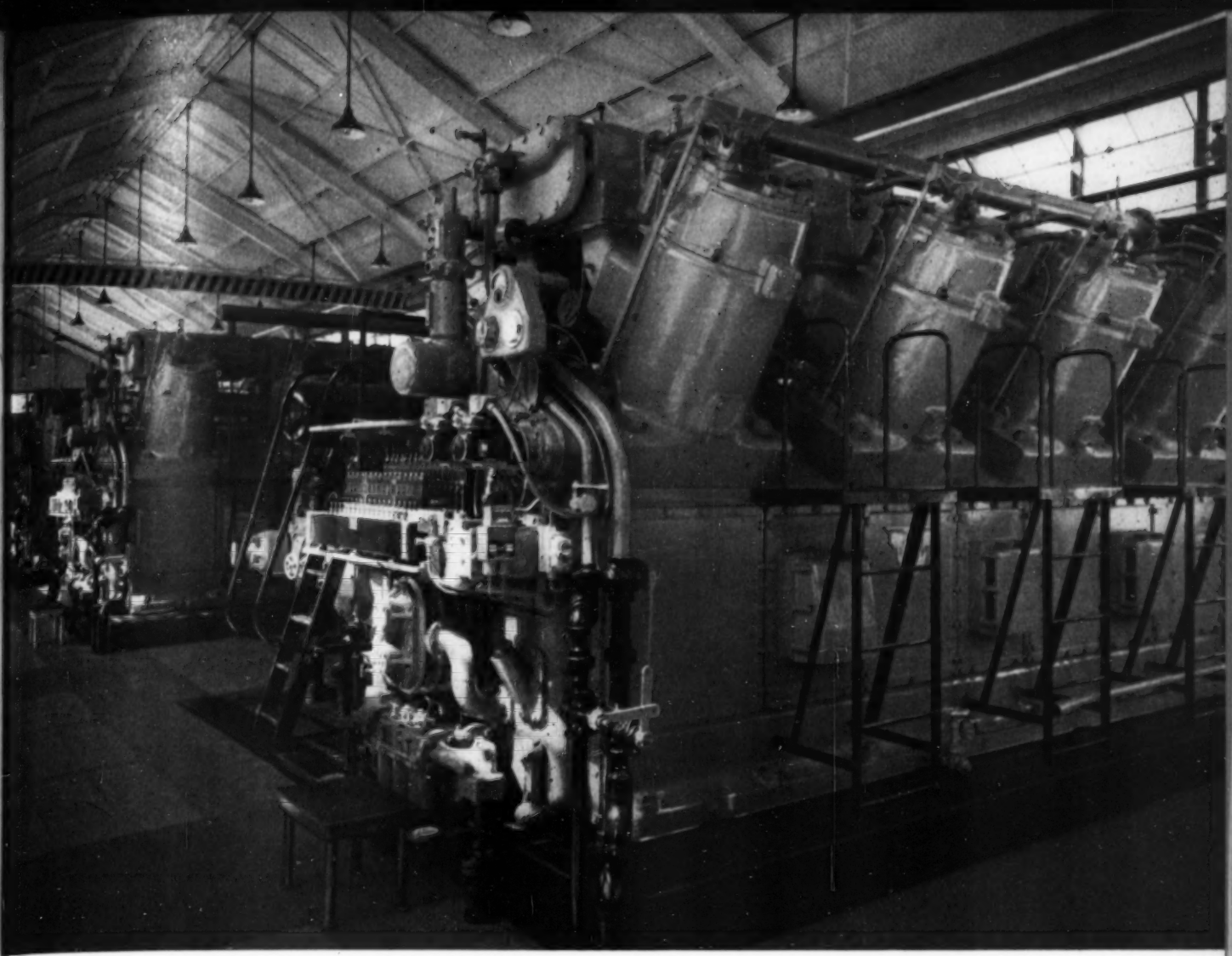
First-cost savings

With high-speed, automotive type engines driving lightweight, intermittent duty air compressors that have been adapted to gas service, some saving in first cost can be shown. Maintenance and operating cost, as well as downtime, will be increased over that of the heavy duty equipment if this type of unit is subjected to continuous 24-hour per day operation. The reason is quite plain: the components were neither designed nor built for this duty. When used in the service for which they were designated, both the engine and the compressor will give excellent performance. Most jobs of gas compression in the oil and gas fields do not fall within this classification.

The heavy duty, direct-connected, gas engine-driven compressor, of the sizes used in packaged compressor units, can be expected to operate continuously for from 20 to 30 years. With proper preventive maintenance, they can be expected to operate 24 hours per day for the full life span.

It is far better to be able to shut the plant down at your convenience for periodic maintenance, than to go out at midnight to make a major repair.

Now, in conclusion, let's summarize the main points that we have covered in detail. A packaged compressor plant is a complete plant, it's fully assembled at the factory, it's compact enough to be transported on oil field trucks. It's adaptable to any use where gas or air must be compressed. Whether used as single units or in large banks of many units, it has been found to reduce the cost of installation and to save on maintenance expense.



Five 880 bhp Cooper-Bessemer GMV's in operation at United Gas Company's Coco station built by the Fluor Corporation. These compressors pump gas from transmission lines into underground storage.

BECAUSE of their unsurpassed flexibility, Cooper-Bessemer compressors were recently selected by The United Fuel Gas Company to pump gas over the wide range of pressures required by an underground storage station.

The Coco Compressor Station, located at Coco, West Virginia and powered by five 880 hp Cooper-Bessemer Model GMV-8-TF compressor units, is one of the larger storage stations in the country. Each GMV is equipped with four 7″ diameter compressor cylinders having a working pressure of 2,000 psi. The GMV's operate against the following variable pressure conditions:

Pumping to Storage

Suction Pressure: 740-850 psig

Discharge Pressure: 900-1900 psig

Pumping from Storage

Suction Pressure: 400-750 psig

Discharge Pressure: 800-900 psig

An important part of this previously unheard of flexibility, available with Cooper-Bessemer compressors, is obtained by using double deck valves. A valve cap unloader replaces the usual flat valve cap. In addition, a bottle type unloader is installed in the outer head of each compressor cylinder. This means twenty unloaders per unit, thus twenty possible unloading steps to handle each pressure condition.

For efficient operation under varying conditions of gas pressure and volume, for compactness, long service life, and low maintenance, you will find Cooper-Bessemer offers the best in dependable low-cost compressor service.

by **Cooper-Bessemer**

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CONSTRUCTION JOBS APPROVED BY FPC — JULY-DECEMBER 1953

Applicant and Docket No.	Description and Purpose	Estimated Cost	Communities Benefited (50,000 Population or More)
Colorado Interstate Gas Co., G-2120, July 3	133 miles of 8⅝ to 20-in. transmission and lateral lines and supply laterals in Kansas and Colorado; 24,860 hp compression in Texas, Kansas, Colorado; to add 83 MMcf capacity for existing customers in Colo. and Wyo.	$19,856,596	Denver and Pueblo, Colo.
Iroquois Gas Corp., G-2129, July 6	6 miles, 16-in. line to connect Aurora storage to Tennessee Gas facilities and 8 miles, 4- and 8-in. field lines in Erie county (N. Y.) to develop underground storage.	800,000	Buffalo, N. Y.; Erie and Pittsburgh, Pa.
United Fuel Gas Co., G-2061-B, July 6	18 miles 20-in. line to connect new storage pool in West Virginia to system, and 3300-hp compression to develop and expand storage operations.	3,557,850	Washington, D. C.; Covington, Lexington, Ky.; Baltimore, Silver Spring, Md.; Binghamton, Buffalo, N. Y.; Columbus, Springfield, Dayton, Toledo, Hamilton, and Cincinnati, Ohio; Allentown, Bethlehem, Erie, Harrisburg, Pittsburgh, Reading and York, Pa.; Arlington, Norfolk, Portsmouth, and Richmond, Va.; Charleston, Huntington, Wheeling, W. Va.
New York State Electric & Gas Corp., G-1999, July 10	49 miles 8- to 10-in. line from connection with New York State Natural at DeRuyter to Oneonta, N. Y., to receive 4 MMcf to serve Norwich and Oneonta, N. Y.	1,732,000	
Northern Natural Gas Co., G-2010, July 30	104 miles 20- and 26-in. trunk lines in Kansas fields; 162 miles 3- to 24-in. branch lines and loops; 2 new compressor stations of 14,520 hp to receive additional gas from Kansas fields for delivery to existing customers.	11,106,421	
Southern Counties Gas Co., G-2182, Aug. 10	14-mile 24-in. line connecting with SoCal's line to Santa Ana, Calif., to increase Orange county supplies.	879,962	
Equitable Gas Co., G-2130, Aug. 27	Additional facilities in Logansport, W. Va., storage pool consisting of 9 miles 12-in. line connecting 1320-hp station to the pool and 3 miles 6- and 8-in. storage area lines, to develop storage facilities for peak-day demands.	1,350,000	Erie, McKeesport, Pittsburgh, and West Mifflin, Pa.
Tennessee Gas Transmission Co., G-1969, Sept. 1	130 miles 26- and 30-in. loop lines; 571 miles 30-in. transmission line from Kinder, La., to Portland, Tenn.; 45 miles 20-in. laterals from Buffalo to International Boundary; 158 miles miscellaneous laterals in Louisiana; and 38,800 hp in new and existing stations. Will increase system capacity by 112 MMcf for transport from Gulf Coast for Iroquois Gas for New York markets and for Niagara Gas Transmission for Canada.	91,718,000	Buffalo, N. Y.; Erie and Pittsburgh, Pa.
Cities Service Gas Co., G-2149, Sept. 25	44 miles 20-in. and 25 miles 16-in. line connecting two gasoline plants and 1100 additional hp, to replace declining supplies and to result in net increase of 12 MMcf to meet increased demands of existing customers.	3,002,700	Kansas City, Wichita, and Topeka, Kan.; Kansas City, Mo.
Pacific Gas & Electric Co., G-2212, Oct. 9	11 miles 24-in. laterals to connect with Pittsburg (Calif.) steam electric generating plant and Standard Pacific Gas Lines for delivery of gas to PG&E's own generating plant and improve connection with Standard Pacific.	992,800	
Central Kentucky Natural Gas Co., G-1905, Oct. 21	9 miles 20-in. loops on mainline between North Means and Foster, Ky. to complete looping and provide additional 85 MMcf a day for existing markets in Cincinnati, Ohio, area.	706,300	Cincinnati, Columbus, Dayton, Hamilton, Springfield, and Toledo, Ohio.
Manufacturers Light & Heat Co.*, G-2059, Oct. 21	52 miles miscellaneous replacement on systems in Pennsylvania, Maryland and West Virginia for rearrangement of systems to improve service and increase deliverability.	2,774,288	Binghamton, Buffalo, N. Y.; Allentown, Bethlehem, Erie, Harrisburg, Pittsburgh, Reading, York, Pa.; Charleston, Huntington, Wheeling, W. Va.
Atlantic Seaboard Corp., G-2062, Oct. 21	7260 hp in new and existing mainline compressor stations in West Virginia to increase capacity by 45.3 MMcf to meet increased requirements of existing customers.	2,986,500	Washington, D. C.; Baltimore and Silver Spring, Md.; Arlington, Norfolk, Portsmouth, and Richmond, Va.
Texas Eastern Transmission Corp., G-2208, Nov. 13	17 miles 6- and 8-in. gas field laterals and new 4400-hp compressor station in Texas, to connect new supply sources, receive gas, and transport 60 MMcf more, which will replace in part diminishing Louisiana supplies.	1,981,900	Bayonne, Camden, E. Orange, Hoboken, Irvington, Jersey City, Newark, Passaic, Paterson, Trenton, Union City, Atlantic City, N. J.; Syracuse, Rochester, Binghamton, Buffalo, Utica, Albany, Troy, N. Y.; Columbus, Springfield, Dayton, Toledo, Hamilton, Cincinnati, Cleveland, Cleveland Heights, Akron, Canton, Lakewood, Youngstown, Ohio; York, Philadelphia, Chester, Reading, Allentown, Bethlehem, Harrisburg, Altoona, Johnstown, Pittsburgh, W. Millin, McKeesport, Erie, Pa.; Charleston, Huntington, Wheeling, W. Va.

* Included Natural Gas Co. of W. Va., Cumberland & Allegheny Gas Co., and Home Gas Co.

FPC authorized 1909 miles of line during last six months of 1953

During the last six months of 1953 the FPC issued certificates authorizing the construction of 1909 miles of natural gas transmission lines with an estimated total construction cost of $176,659,963. With these new facilities, nearly ½ billion cu ft of daily delivery capacity will be added to the nation's individual transmission systems.

Approximately $143,445,317 of the total cost was for major projects, those estimated to cost $700,000 or more. Sixty-two communities of 50,000 population or more in 11 states and the District of Columbia, as well as numerous small communities will benefit, according to FPC Chairman Kuykendall's report.

401-MMcf increase

The largest projects will increase the daily delivery capacity of systems involved by more than 401 MMcf, involve construction of about 1568 miles of pipeline, and install

THE 1954 FLUOR FIN-FAN

offers improved engineering features for:

COLD WEATHER PROTECTION

For protection during severe cold and to prevent exit fluid temperatures from dropping below the design point, Fluor Fin-Fan air-cooled heat exchangers may be equipped with louver-type shutters over the fin-tube sections, or with rolling steel doors at ground level to regulate the flow of air across the extended surface. In extreme cases air can be recirculated to maintain desired temperatures. Fluor furnishes Fin-Fan installations for reliable performance under any weather conditions.

AUTOMATIC TEMPERATURE CONTROL

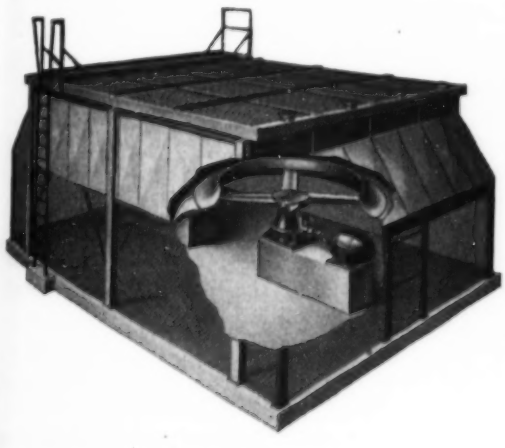
In addition to the above, Fluor makes available automatic temperature control equipment which, by means of varying fan speed, assures constant exit fluid temperatures. Savings in operational horsepower are also effected. The type of equipment available consists of variable speed fluid drives (hydraulic couplings) and variable speed hydraulic drives.

IMPROVED HEAT TRANSFER

Fins are applied to the tube so that each individual fin overlaps at its base and seals against the adjacent fin, completely encasing the entire length of the tube, thus resulting in improved heat transfer efficiency. Protected from exposure, tubes do not require a coating to prevent them from corroding. Fins remain rigidly in place with no opportunity to work loose. Tubes are furnished in Admiralty, carbon steel, aluminum or any other commercially available material.

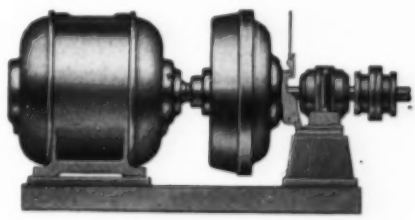
PROTECTION TO EQUIPMENT

The Vibration Cut-Out Switch, which immediately cuts off power should excessive vibration occur, was developed and patented by Fluor. These switches have long been standard equipment on Fluor induced-draft cooling towers and Fin-Fans, and proved their worth by cutting off the power at recycle and gasoline plants during the earthquakes in and around Bakersfield in the summer of 1952. They also serve as a position on-off switch during routine inspections. Manual reset prevents motor from being started accidentally when the switch is in "off" position.

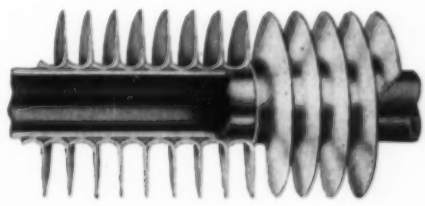


FLUOR LOUVER SHUTTERS mounted above the fin-tube sections offer protection during cold weather and regulate the flow of air across tubes to maintain constant exit fluid temperatures in frigid climates.

ROLLING STEEL DOORS may be used in place of shutters for controlling amount of cooling air through fan and for protection during severe cold weather.



VARIABLE SPEED FLUID DRIVE regulates fan speed automatically, controls temperatures, saves power, increases operational life of mechanical equipment.



FIN stock completely encases the tube from one end to the other to provide high heat transfer efficiency while protecting tubes from corrosion.

VIBRATION CUT-OUT SWITCH immediately cuts off power and stops fan, should excessive vibration occur, thus preventing possible damage to Fin-Fan.

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tion of compressor facilities aggregating 95,560 hp.

Tennessee Gas Transmission Co. received authorization for the largest project: Approximately 904 miles of various sized loops, laterals, and transmission lines, and 38,800 hp in new and existing compressor stations. Estimated cost: $91,718,000 (see table).

Year totals

During the 1953 calendar year, the FPC authorized construction totaling 6800 miles of pipeline and 544,180 hp compressor installations, at a total cost of $725,642,473, and adding 2½ billion cu ft of daily delivery capacity.

During the 12-year period that the certificate provisions of the Natural Gas Act have been in effect, the FPC has authorized construction and operation of a total of nearly 55,000 miles of pipeline and almost 4 million hp in compressor units. Total estimated cost of the facilities is more than $4063 million; more than 2½ billion cu ft of daily delivery capacity was added. However, the quantity of this additional gas to be delivered directly from transmission facilities to the nation's markets will be somewhat lower because in some cases the same gas will be transported through new facilities of two or more pipeline systems.

Ultimate market

Chairman Kuykendall also pointed out that, in connection with the total estimated delivery capacity, there is an increasing trend toward the development and operation of natural gas storage areas nearer to the ultimate market. This trend will have the effect on these markets, particularly in winter peak periods, of allowing the pipeline companies more nearly to utilize the maximum transmission capacities of their respective systems during the warmer periods, thereby curtailing the need for additional transmission capacity. Thus, he continued, the impact of nearby storage operations upon the nation's gas market is becoming an important factor that is not reflected in the estimates shown by the FPC report in the additional capacity being made available to the markets. This is because of the nature of this type of operation, which acts to stabilize supply and insure continuity of service, but does not lend itself to any reliable criteria for measuring the increased capacity made available for service to markets.

Pipeline Communications and Electronics

By FRANK CHAPMAN

Communications men gather at New Orleans conference

Frank Chapman

None of the informal discussion sessions held as a part of the AGA spring conference on gas supply, transmission and storage covered a broader part of its own field of interest and got into the detailed matters of operation any more than the one which was made up of men responsible for the communication systems of the gas industry.

Under the leadership of H. A. Rhodes, Transcontinental Gas Pipe Line Co., the communications luncheon held on the first day of the New Orleans meeting followed a morning general session talk by Joseph E. Keller, of Dow, Lohnes and Albertson, Washington, D. C., who is special representative for the Central Committee on Radio Facilities of the American Petroleum Institute and the National Petroleum Radio Frequency Coordinating Association.

Mr. Keller, in his morning talk, emphasized the recent growth and present extent of the gas industry's communications facilities. The present size of the industry's communications facilities, he pointed out, is indicated by the fact that the petroleum radio service, about half of which is made up of gas distribution and transmission company facilities, has one and one half times more facilities than all the other services combined.

With respect to microwave communication alone, he said that microwave systems now operated by 22 companies in the petroleum radio service total 14,584 miles and represent an investment of over $17 million. This network exceeds all other microwave facilities combined, including common carrier relay, by 50% and represents a growth of only three years. He also emphasized the importance of a coordinating body in the face of the continually growing demand for radio frequencies.

During the afternoon informal session Mr. Keller's remarks with respect to the lack of available frequencies was accented by T. G. Humphreys Jr., of Alabama Gas Corp., who pointed out that frequencies for both petroleum and utility use were at a point of saturation in Louisiana and the Gulf coast area as well as parts of New England. Mr. Humphreys is chairman of the National Committee for Utilities Radio.

The problem of congestion in certain areas on mobile frequencies and the possibility of splitting present 40-kc channels into two 20-kc bands was discussed. Consideration was given to some of the details of equipment conversion required for such a undertaking. It was also pointed out that present congestion could be alleviated to some extent on frequencies shared by several users if improved operating procedures were to be adopted.

J. W. Flint, Cities Service Gas Co., Wichita, Kan., detailed the present position of the industry's extensive privately owned wire line communication systems with emphasis on recent developments in the field such as the use of companders and noise suppressors for improving circuit quality particularly with reference to dross talk, induction interference, and general noise caused by circuit unbalance. He also commented on present-day pole line construction costs and the use of commercial communication facilities.

L. I. Duthie, El Paso Natural Gas Co., discussed his company's experience with microwave systems in both the 2000 and 6000 mc bands. He said that he felt the 2000 mc installation was justified on the basis of his com-

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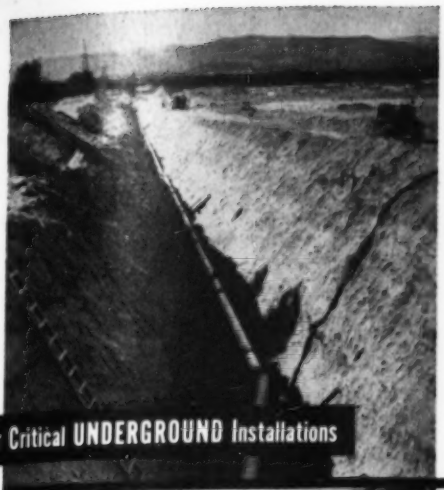
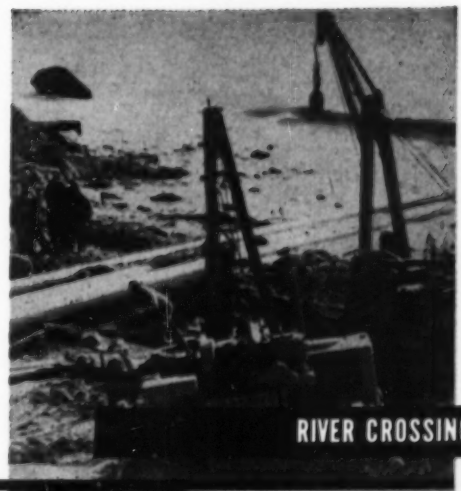
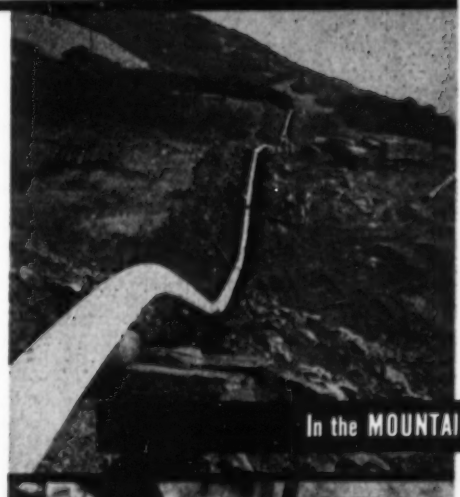


For Critical UNDERGROUND Installations



RIVER CROSSINGS

In the CITY



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3. The CENTRILINE Process
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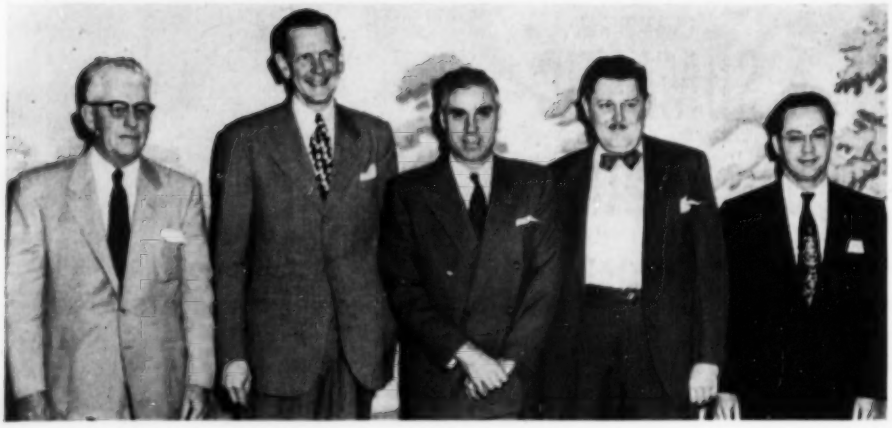
• • •

4. Centrifugally Spun Cement Mortar Lining of pipe 4" to 16"



Men who took part in informal discussion of communications are (l to r) J. W. Flint, Joseph E. Keller, H. A. Rhodes, T. G. Humphreys Jr., and L. I. Duthie.

pany's telemetering requirements. Outages on the system, he said, were largely due to the delay in repair personnel reaching the point of trouble.

Detailed operational problems discussed by the group included the use of heavy duty generators in all automobiles equipped with radio facilities. One company reported that it installed battery chargers on each truck equipped with radio. The problem of converting mobile equipment from 6- to 12-volt operation was also discussed in detail and several methods by which it might be accomplished were outlined. As if to emphasize the minute details with which the session was concerned a discussion developed on the merits of connecting mobile radio equipment through or ahead of the automobile ignition switch.

Suggests committee

Returning to problems of a broader nature, it was suggested by Mr. Keller that members of the communications committee serve also as a coordinate committee within the framework of the Central Committee on Radio Facilities of the API to further integrate the work of these two groups. The committee would not lose its identity with the AGA, but would also be known as the natural gas committee within the other group. It was pointed out that while the communications committee of the AGA is concerned with both distribution and transmission company problems, the API group is only concerned with transmission or pipeline problems.

In calling for recommendations for next year's program, Mr. Rhodes found a lively interest in telemetering on radio circuits in both distribution and transmission companies. The use of this kind of service along with supervisory control has grown rapidly during the past few months and the communications men were of the opinion that its application would continue.

Remote control

The subject of remote control, particularly with reference to the use of turbine-driven centrifugal compressor stations, was also suggested as a subject that should come in for some discussion. Looking still further into the future it was suggested that some thoughts on the use of closed circuit industrial television, as a part of a program of remote control, would also be in order.

The session was presided over by H. A. Rhodes, in the absence of W. T. Bulla, Natural Gas Pipeline Co. of America, who is chairman of the communications committee.

Recent FCC authorizations

The following authorizations have been issued by the Federal Communications Commission in the petroleum radio service:

1. Southern Natural Gas Co., Birmingham, Ala., for three base stations at Ellerslie, Ala., and in Georgia and South Carolina on 49.06 mc., two fixed control stations at Montieth, Ga., on 72.70 mc., and at Macon, Ga., on 456.45 mc. and one fixed relay at Egypt, Ga., on 75.70 mc.

2. California Co., New Orleans, La., for one base station at Venice on 33.18 mc.

3. El Paso Natural Gas Co., El Paso, Texas, for two base stations at Gobernador, N. M., and at Ignacio, Colo., on 48.74 mc., and 22 fixed units at Grants, Tecalote, El Paso, Orogrande, and Farmington on 1855 mc., at El Paso, Fruitland, Three Rivers, Thoreau, and Manzano on 1895 mc., and at Tohatchi on 956.1 mc. and at Gibson on 1855 mc. and 959.7 mc.

RCA issues microwave booklet

A profusely illustrated booklet describing the application and operation of pipeline microwave systems in text and illustration has recently been issued by the Radio Corporation of America.

The booklet opens with an interesting non-technical description of how microwave works and what it offers to the pipeline operator. It proceeds to point out several advantages of the system over wire line communication and, taking excerpts from testimony presented before the FCC, shows the importance of multi-channel communication facilities to the industry.

Several interesting applications of RCA microwave installations are described in a non-technical way, including the El Paso Natural Gas Co. system in New Mexico and Texas. This system, which includes nine stations on the main system and four leg circuits, carries three voice channels and 19 telemetering channels.

RCA equipment for 960 and 2000 mc. is pictured and described in some detail along with the various types of terminal channeling equipment that can beu sed with either system.

Copies are available on request (on company stationery) to Microwave Communications Equipment, Engineering Products Division, Radio Corporation of America, Building 15-1, Camden 2, N. J.

Congress may argue licensing fees

A bill that would bring congress into the matter of FCC licensing fees as opposed to a pending commission ruling that would cover this matter has been introduced by Sen. Edwin C. Johnson (D.-Colo.). The commission ruling is an outgrowth of a directive by the Bureau of the Budget to the FCC, among other departments of the government, that activities that have to do with licensing and registration must be self supporting.

The bill introduced by Senator Johnson would "prescribe nominal fees or charges for any inspection, certificate, registration, license, permit or application," and prohibit the charging fees of more than a nominal nature. Prior to the introduction of his bill, Senator Johnson directed a letter to the chairman of the FCC in which he stated that, "the question of fees as proposed by the commission is so fundamental to the principles that underly the Communications Act that any departure from it should be resolved by Congress. The Congress may very well find that the imposition of fees for licenses and related activities is reasonable and does not compromise these principles. However, this is a judgment that should be made by Congress after full hearings in which everyone would be given an opportunity to be heard."

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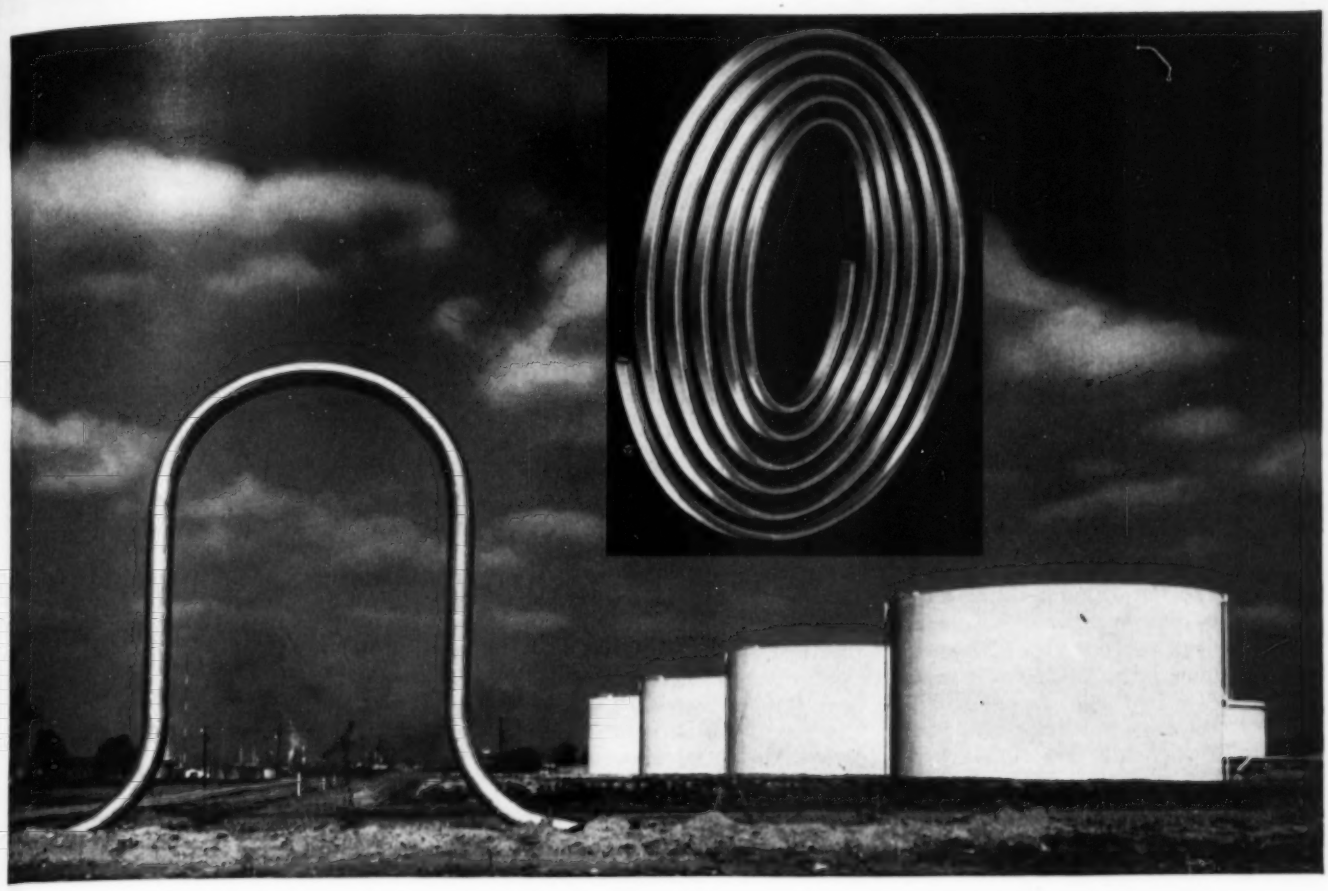

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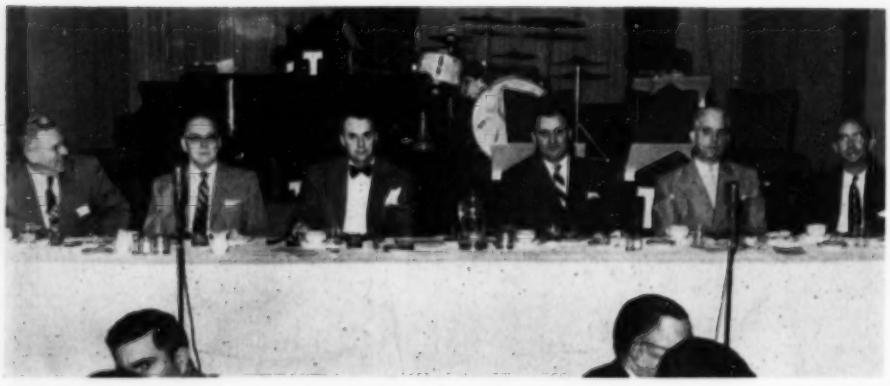

Group that led discussion on underground storage (from left) Mark Burlingame, C. W. Studt, J. V. Goodman (chairman), C. C. Ingram, L. R. Kirk, J. B. Corrin Jr.

Every phase of gas delivery covered during New Orleans conference

ONE of the truly remarkable things about an AGA operating section conference is the way in which it takes the form of a smoothly working body, becomes intimately involved in myriad details concerned with the vital problems of gas delivery and goes out of existence—all within the relatively short span of a single meeting. The annual meeting of the gas supply, transmission and storage conference, held in New Orleans on March 4-5, was a typical example of such a conference.

With but two days in which to work, the New Orleans conference rounded out a program of meetings that touched on every important phase of gas delivery from the wellhead to the user. The sessions were so designed that subjects introduced by speakers during the more formal general sessions, held during the morning, were carried over into separate luncheon and informal round table discussions during the afternoon. These discussions were concerned with such matters as compressor stations, pipeline construction, communications, gas processing and production.

"Table hopping"

Many delegates found themselves "table hopping" from session to session during the afternoon because of an interest in more than one of the separate informal meetings. It was in the informality of these afternoon sessions that specific and often controversial matters were discussed in detail. Matters of broad interest such as section reports were relegated to the morning sessions.

As if to take full advantage of its new designation as a gas supply, transmission and storage conference, this year's meeting went into some of the more detailed matters of gas production and gas processing. Included were general session papers on well drilling techniques, which were carried over into the informal afternoon meetings, and the discussion of dehydration. The informal meetings on compressor station and pipeline operation got the most attention.

The meeting was also characterized by the attendance of top level operating personnel. Among the nearly 500 gasmen who registered for the sessions were representatives from nearly all of the country's major gas companies. Next year's gathering, scheduled for Pittsburgh in late March, is expected to exceed this attendance mark.

Grove Lawrence, Southern California Gas Co., chairman of the transmission committee, presided at the opening general session; and John V. Goodman, Equitable Gas Co., chairman of the section's committee on underground storage, took over the second day's morning general session. The combined luncheons and informal afternoon sessions were presided over by subcommittee chairmen and others closely associated with the subject under discussion.

A general session report on modern-day developments in compressor station operation by Rex. V. Campbell, Michigan-Wisconsin Pipe Line Co., which was carried over into an afternoon informal discussion of compressor station operation, was an example of how the sessions were designed so that the morning meeting would serve to spark the afternoon discussions. In a similar manner remarks by Joseph E. Keller, specialist on utility relations with the Federal Communications Commission of Washington, D. C., made during his morning session talk on the first day of the meeting, were brought up and discussed in greater detail during the afternoon meeting on communication problems.

Mr. Campbell's discussion of modern practice in compressor station operation also served to point out the practical nature of the New Orleans meeting. He traced the relatively short but rapid growth of the industry in terms of the compressor station. He pointed out that whereas 20 years ago it was common practice to install horizontal compressors of 1000 to 1600 hp, which occupied some 2100 sq ft of engine room space, present-day turbine-driven compressors of 6700 hp and above may be installed in less than 1700 sq ft of space.

He continued to enumerate the changes that have come about in the design and operation of compressor stations over the period of this development. He also indicated instances where progress is still needed. He gave the matter of water treatment in the compressor station as an example of an instance where the industry has come a long way, and at the same time an example of a field in which more progress is required.

Compressor station maintenance

This talk served as an introduction to the afternoon session on compressor station maintenance during which the matters of engine lubrication and maintenance cost considerations were discussed in detail. The session also included a lively discussion of gas cleaners.

In his remark with respect to the gas industry's use of various types of communication facilities, made during the opening session of the conference, Mr. Keller not only set a practical course for the session but also paced the afternoon's informal meeting on communications. (See section on "Pipeline Communications and Electronics" in this issue).

He also urged gas industry management to carefully consider any offer by a common carrier to take over the company's radio communication facilities. He emphasized the vital nature of radio to the industry and pointed out that a privately owned and operated system provides a more serviceable and more economical operation.

Pipeline construction practices, particularly with respect to welding techniques and the bearing which good practice has upon

Panel members who led Friday's informal discussion into compressor station problems (from left): Robert Jefferies, Conrad Marvin, N. C. Comfort (chairman), L. M. Gibson, S. A. Bradfield, E. M. Rowland.

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the widely discussed code for pressure piping, were discussed in both formal and informal sessions. During a morning general session, D. C. Palm, Natural Gas Pipeline Co. of America, told of the practical measures necessary to eliminate the possibility of pipeline breaks.

In pointing out that a line is no stronger than its weakest link, he recommended three considerations that should be made to prevent pipeline breaks: The choice of good materials, care in field construction of the line, and proper maintenance of the line after construction.

In the informal pipeline session that followed Mr. Palm's discussion, some of the specific problems of pipeline construction and operation were detailed. H. A. Proctor, Southern California Gas Co., summarized his company's experience in welding high pressure gas transmission lines.

During the same session L. L. Elder, Columbia Gas System Service Corp., outlined the personnel and equipment required for proper pipeline maintenance. A discussion of the procedures and methods of pipeline cleaning was led by Clinton McClure, El Paso Natural Gas Co.

A progress report on the ASA code for pressure piping was given by F. A. Hough, Southern Counties Gas Co. and chairman of Subcommittee 8 on gas transmission and distribution piping, at the second day's morning general session. The afternoon meeting included a discussion of inspection practices during pipeline construction by N. F. Blundell of Gulf Interstate Gas Co.

W. Aubrey Roberts, Texas Gas Transmission Corp., led a discussion on the maintenance of pipeline right-of-way. He pointed to his company's highly successful experience with right-of-way maintenance through the use of personal contact with persons along the line, he said, however, that it is becoming increasing difficult and expensive to get pipeline right-of-ways. He blamed this partially upon bad handling of the farmers and land owners by the transmission company, and upon the carelessness of transmission company personnel. He warned that careless practices in right-of-way maintenance is bringing on regulatory legislation in some states that will require the company to follow certain practices in their maintenance procedures.

The importance of developing competent management personnel by and for the engineering departments of the gas company was emphasized by Leslie A. Brandt, the Peoples Gas Light and Coke Co., during the first general session.

He told of the experience that Peoples Gas has had with a management training program and outlined the objectives which his company has set down for their program.

Representing the Federal Power Commission, Carl T. Kallina, chief of the division of gas certificates, discussed the interconnection of major gas pipelines.

The 1955 conference will be held at the William Penn hotel in Pittsburgh, on March 24-25.

PIPELINE NEWS

Canada approves line to bring U. S. gas to Toronto

The Canadian government has approved, in principle, of the plan to build a $7 million pipeline to bring U. S. gas into Toronto. The bill will allow Niagara Gas Transmission Co. to obtain government permits to build the 75-mile line from a border point on the Niagara river to Toronto. Permission of the Canadian Parliament is required for the "extra-provincial" project. The line will be capable of carrying 22.6 MMcf of gas a year.

The gas will come from Louisiana and Texas along Tennessee Gas Transmission Co. lines to the border. Tennessee owns 35% of the shares in Niagara Gas. Consumers Gas Co. of Toronto, which will distribute the gas to Toronto district users, owns the rest.

Meanwhile, Hydro Chairman Robert Saunders confirmed the report that the Ontario commission will not participate in the distribution of natural gas in Ontario when the trans-Canada line is built. Earlier reports had said that the commission would take an important part in the gas distribution.

It has also been reported that interest in Alberta has swung from gas export to gas gathering within the province. Special legislation will be introduced in the current session of the Alberta Legislature to form a provincial company for construction and operation of a trunkline gathering system, in line with recommendations of the Alberta Petroleum & Natural Gas Conservation Board.

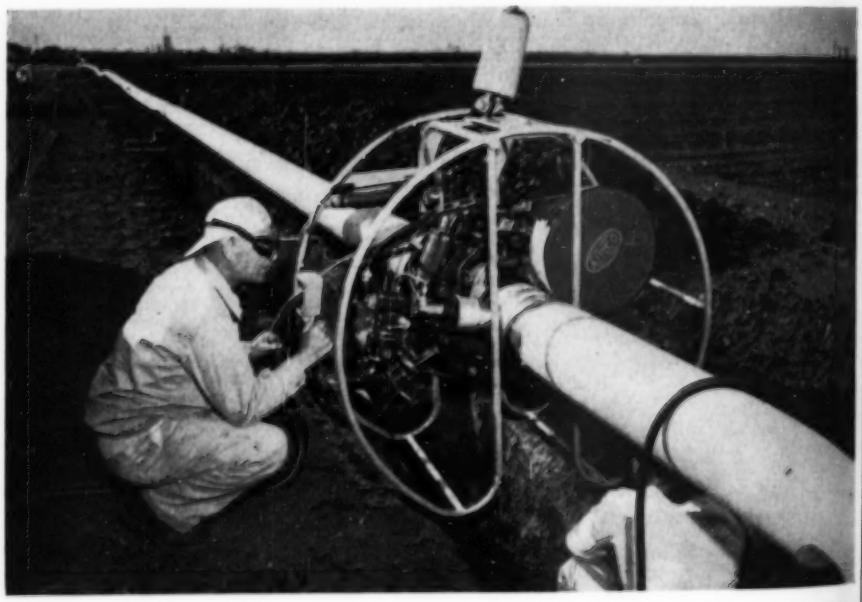
The board recommended the trunkline system, operating within the province as a common carrier and under full provincial jurisdiction and control, believing that such a line would make possible an economic supply of gas to Alberta communities and to export markets.

New automatic welder used on longest aluminum line

A new portable automatic welding machine, used during the laying of the longest aluminum pipeline ever installed, has performed so rapidly that it passed the ditching machines and worked on ahead of them—a feat rarely accomplished in hand-welding operations.

The new machine is being used in laying of the 12-mile high-pressure pipeline between the White Point gas field near Corpus Christi, Texas, and the Reynolds Metals Co.'s La Quinta alumina plant. It is claimed that the new automatic welder, developed by Reynolds in conjunction with Air Reduction Sales Co., makes aluminum pipeline competitive with steel in cost, without considering many additional advantages of aluminum pipe.

The machine welded 40-ft sections of 8 and ⅜-in. aluminum pipe in an average time of four minutes for a five-pass weld, compared to about eight minutes or more for welding pipe in place by hand, the method commonly used for steel pipe and which heretofore has created technical problems in the welding of aluminum pipe. Suspended over the line by a side boom, the automatic welder is equipped with quick-acting clamps which securely grip the pipe. Pressing a button starts the welding, and automatic controls maintain proper conditions at the arc. When the weld is complete,



This new type automatic pipe welder was developed by Reynolds Metals and Air Reduction Co. With it, pipe welds are made that will withstand 25% greater burning pressures more than heretofore obtainable.

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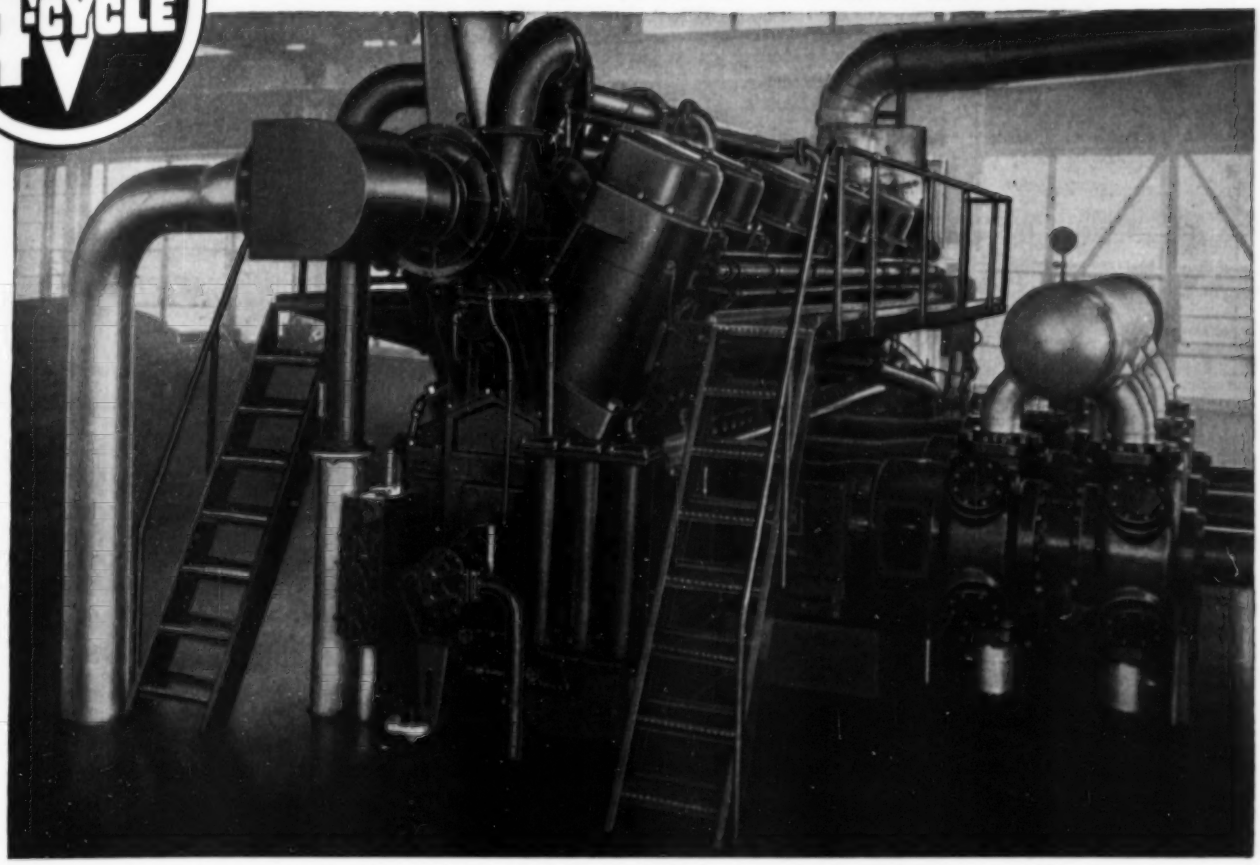

Here's the first installation of a TURBOCHARGED gas-engine-driven compressor. This Ingersoll-Rand KVS unit went on stream early in 1952. Its performance has lived up to every expectation.

The FIRST TURBOCHARGED gas-engine-driven compressor!

...2000 hp, 4 cycle

...developed through TEN YEARS of experimentation on FOUR full-sized engines

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...service proved for more than a year

...a large number of production units now being built and installed

In the new TURBOCHARGED "KVS" engine, waste energy from the exhaust provides power for scavenging and supercharging, through two gas-turbine-driven centrifugal blowers, one at each end of the machine. The result—a new high in efficiency and economy! Note these outstanding advantages:

MORE POWER IN LESS SPACE
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NO AIR COOLING
ECONOMICAL COOLING SYSTEM
EASY STARTING
FOUR COMPRESSION CYLINDERS
ULTRA CONSERVATIVE RATING

Features such as these make the new KVS an important advance in the design of Ingersoll-Rand's traditionally dependable V-angle, 4-cycle gas engine. Ask your I-R representative for the complete story.

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the machine automatically stops, reverses itself, and returns to the starting position. The clamps are then released, and the machine moves to the next weld.

W. B. Moore, Reynolds' manager of chemical and petroleum market sales, said: "Development of an automatic method of welding has been the missing link in making aluminum competitive with steel pipe for high-pressure gas lines." Mr. Moore explained that aluminum already is competitive for low-pressure gas and oil lines, such as field gathering systems.

The largest diameter pipe now made by Reynolds is 12-in., but the aluminum firm now is planning facilities at its Phoenix extrusion plant for manufacture of pipe up to 32-in. in diameter.

The welds made during the laying of the 12-mile high-pressure link were subjected to pressure as high as 1800 psi and held firmly. The 40-ft aluminum pipe sections used weigh only 230 lb while the same size section of steel pipe weighs about 1000 lb.

Although pipe in the new White Point-LaQuinta line is wrapped, this is unnecessary in many instances. If aluminum pipe is wrapped, it does not require cleaning after storage to remove mill scale or rust. Wrapping of aluminum pipe therefore costs about 30% less than for steel.

Maintenance costs for aluminum pipe are notably lower, Reynolds spokesmen said, because painting of aluminum used in overhead or exposed installations is unnecessary, while steel must be carefully painted and maintained to prevent rust.

The pipe in the welding demonstration was coated with a primer and 3/32 of an inch of bitumastic enamel. This was followed by a fibre-glass wrap and 60-70 pound Kraft paper. The binding of the coating to the aluminum pipe, Reynolds representatives showed, was unusually good. The damage often incurred in handling pipe after shop-wrapping also is minimized by the use of the lightweight aluminum.

The line being laid near Corpus Christi is the first full-scale use of the newly developed automatic welding machine. Short test lines with smaller diameter pipe were laid earlier at Listerhill, Ala., for the Alabama-Tennessee Natural Gas Co., and at Jal, N. M., for the El Paso Natural Gas Co. Both installations proved successful and made it possible to perfect the process.

Portable booster division added by McNamar Boiler

McNamar Boiler and Tank Co., Tulsa, fabricator of line pipe, tanks and other equipment for the gas and petroleum industry, has created a portable gas compressor division to fabricate and sell skid-mounted portable gas boosters and repressuring units. M. C. Bolin Jr., formerly sales manager of the LP gas division, has been appointed manager of the new department of the company.

The McNamar-Joy booster units feature the Joy compressor and include engine, all necessary scrubbers, automatic controls and cooling apparatus. The unit is delivered ready to install as a complete unit to the customer's lines.

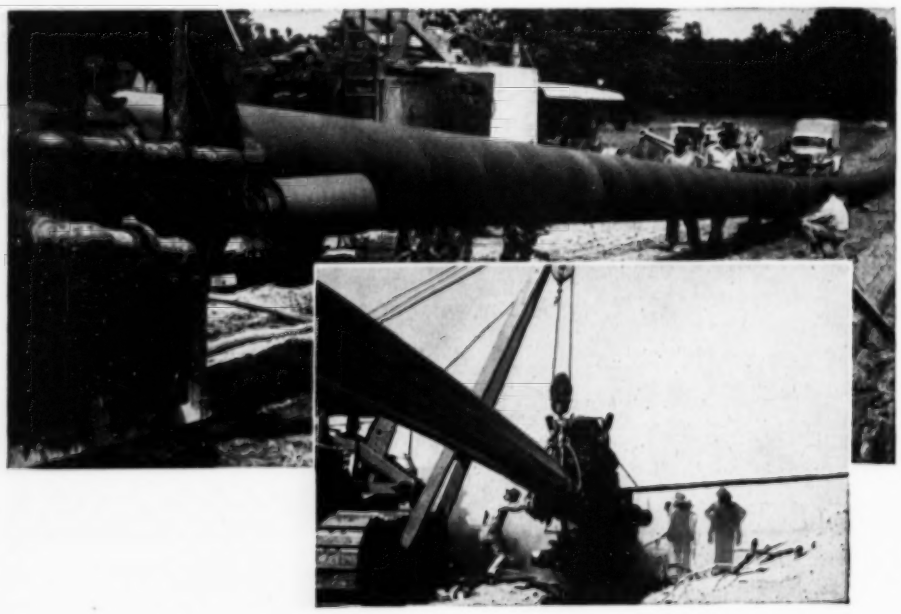
Panhandle and consolidated hearings postponed

Consolidated FPC hearings previously scheduled to commence March 3 on several related proceedings involving the delivery capacity of the transmission system of Panhandle Eastern Pipe Line Co., Kansas City, Mo., were postponed until April 5.

The hearings include two cases remanded to the FPC by the U. S. Court of Appeals for the Third Circuit, two applications involving the proposed abandonment of service by Panhandle, and one application by a city and two by companies which are seeking supplies of natural gas from Panhandle.

El Paso withdraws notice of rate cancellation

The Federal Power Commission has permitted El Paso (Texas) Natural Gas Co. to withdraw its notice of cancellation of its rate schedule covering common carrier ser-



Mile after mile – to last for years

This line is being wrapped with RUBEROID pipe line asbestos felt over PITT-CHEM. hot applied tar base coating. An S. D. Day man was on hand when these jobs were started to give his help and advice — part of the follow-up service you get when you "DEAL WITH DAY."

The ability of RUBEROID asbestos felt and PITT-CHEM. coal tar enamels to meet and withstand the severe requirements of pipe line service against corrosion adds years to the useful life of pipelines. Both of these products are stocked in Houston for immediate shipment.

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The Pipeliner's Friend says,
"Formula 291 gives skin protection for those working where fumes may be toxic."

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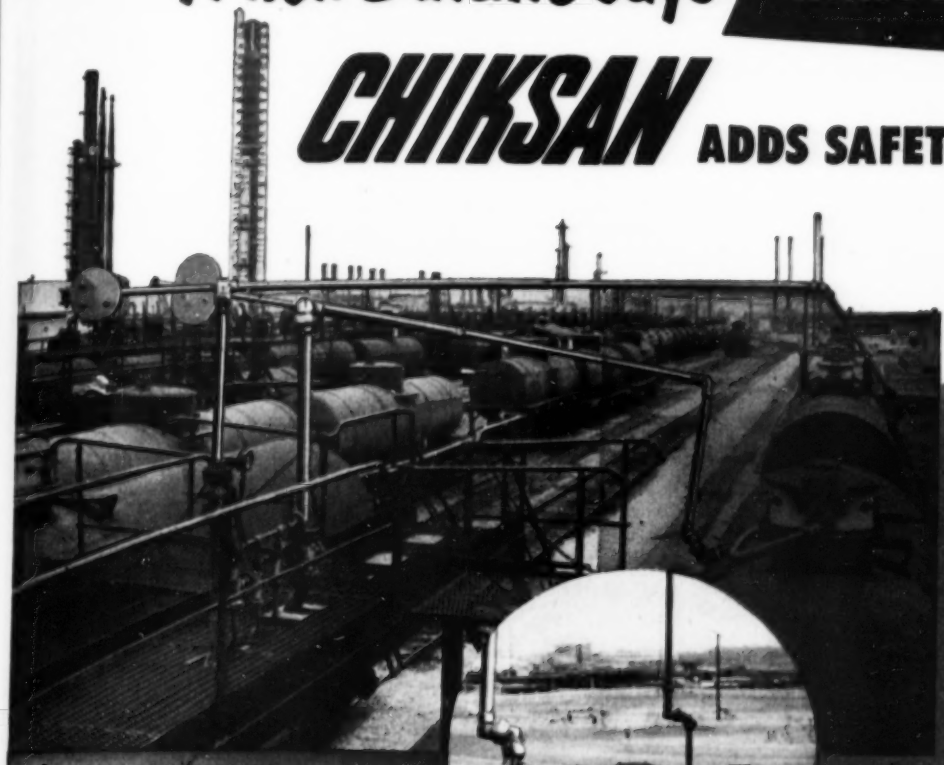
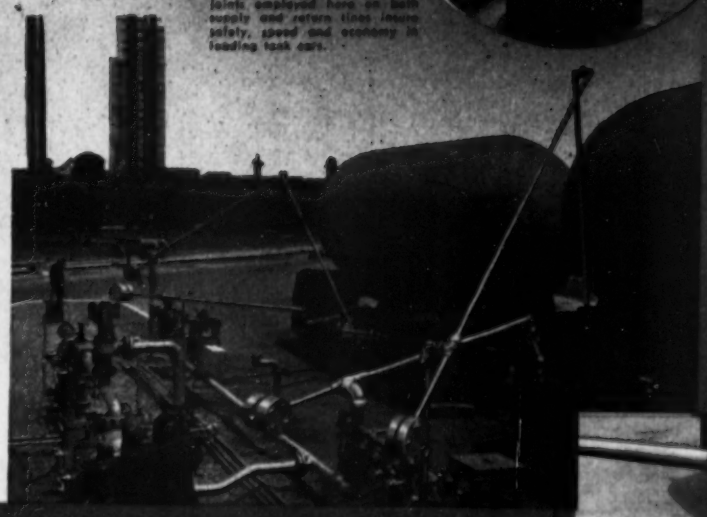


With counterbalanced Chiksan loading racks, one man can quickly and easily make connections to tank cars.

CHIKSAN low pressure swivel joints employed here on both supply and return lines insure safety, speed and economy in loading tank cars.



It takes speed, safety and kid-glove handling to keep up the massive flow of liquefied petroleum gas at Standard Oil Company of California's El Segundo plant.

Chiksan provides the necessary liquid-tight, gas-tight unions, the characteristic flexibility of motion to keep the touchy Butane flowing at a swift, even pace with safety to workers, plant and community—with profit to the company.

No less than eight Chiksan Ball-Bearing Swivel Joints are needed for each loading installation to keep the gas moving into tank and truck—to provide the essential carry-off of the highly explosive vapors. And with Chiksan on the job, metal of relative low porosity takes the place of more porous and less safe rubber.

Standard Oil Company of California's El Segundo installations are typical of industry's reliance on Chiksan Ball-Bearing Swivel Joints around the world to speed the flow of enterprise—to promote production and defense—to increase safety—to protect profits.

Wherever liquid or gas must flow in industry—wherever hydraulic systems can add efficiency and economy—Chiksan Ball-Bearing Swivel Joints are on the job. If more flexibility—greater stamina—longer life and added economy are of interest to you, Chiksan's Research and Development Division can help you find a better, swifter way.

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ice on its natural gas pipeline system.

The commission at the same time terminated the proceedings instituted Dec. 4, 1953, when it suspended El Paso's proposed cancellation. A hearing had been scheduled to commence March 1 in Washington, D. C.

When it suspended the proposed cancellation, the FPC said that it had received several protests or objections to El Paso's proposed action. El Paso filed a notice of withdrawal on Jan. 28, stating that since "objection has been voiced," it desired to withdraw the application.

Public documents to be accepted by FPC at hearings

The FPC has issued an order amending its rules to permit the receipt of public documents in evidence at hearings by reference even though such documents are not actually produced and are not part of the FPC's official files.

The rules previously provided that all documentary evidence in a hearing must be produced and marked for identification, with the exception of those reports or other documents that are a part of the material in the Commission's files.

The new amendment broadens the scope of the exception to include published reports, documents or other official governmental publications regularly consulted as sources of basic facts, and which are accessible to the public generally but are not part of the FPC's official files.

Colorado-Western seeks to build second line

Another application has been filed by Colorado-Western Pipeline Co., Denver, with the Colorado PUC (see GAS, February, page 136) which calls for an expenditure of $21.6 million for 328 miles of 16- and 18-in. line, running from the Ignacio gas field in southwestern Colorado to Denver, Pueblo and Colorado Springs.

The line, which would be in competition with Colorado Interstate Gas Co.'s system that has supplied major Colorado cities since 1928, would be supplied by El Paso Natural Gas Co. and Three States Natural Gas Co. John A. McGuire, who heads both Colorado-Western and Three States, says that he still plans to build the other line, "as soon as we find more gas."

Witnesses appearing before PUC hearings on behalf of Colorado-Western based their plea on the grounds that Colorado natural gas be used for the development of Colorado under the state's own regulation. They insisted that not only would the state be using its own resources for its own development, but that they could supply a tremendous new volume of gas for the Colorado market at a price 20% below that of an interstate competitive pipeline.

Principal opposition is from the Pacific Northwest Pipeline Co. and Colorado-Interstate. Pacific's application is still pending before the FPC to run a line from the San Juan basin fields into the northwest. Colorado Interstate would connect with this line at Rock Springs, Wyo., and bring the gas into Denver.

TGT gets one rate okay; plans fourth increase

On the heels of FPC approval of a $4,767,800 rate increase, Tennessee Gas Transmission Co. has announced that it expects to ask the FPC for its fourth general increase in rates in May. The newly approved rate increase originally was for $6,510,100.

In other rate cases last month, the FPC allowed a service agreement filed by United Gas Pipe Line Co., Shreveport, providing for an $85,600 reduction in natural gas rates, to take effect, but suspended two other proposed service agreements that would increase the company's rates by $347,000 annually.

The FPC approved a settlement of rate proceedings involving Atlantic Seaboard Gas Corp. and Virginia Gas Transmission Co., Charleston, W. Va., providing for an estimated reduction of about $2,856,000 per

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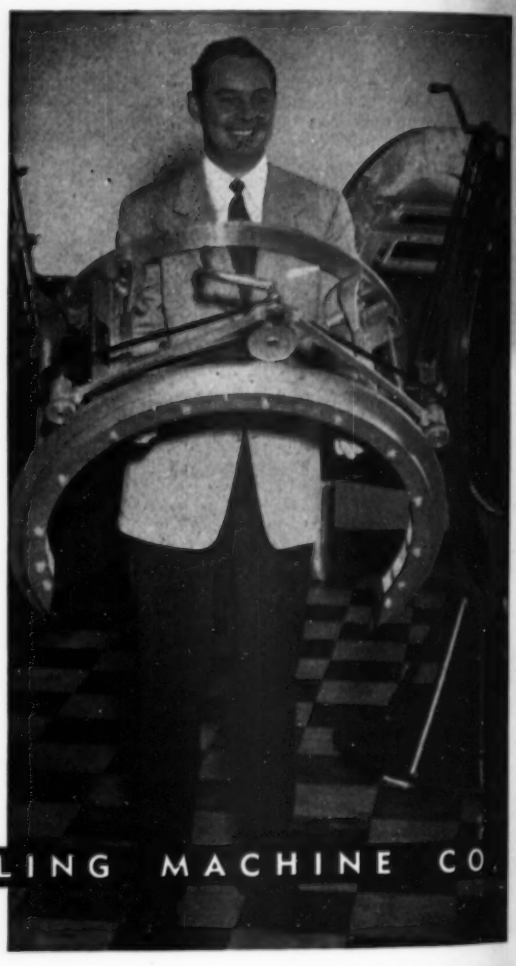

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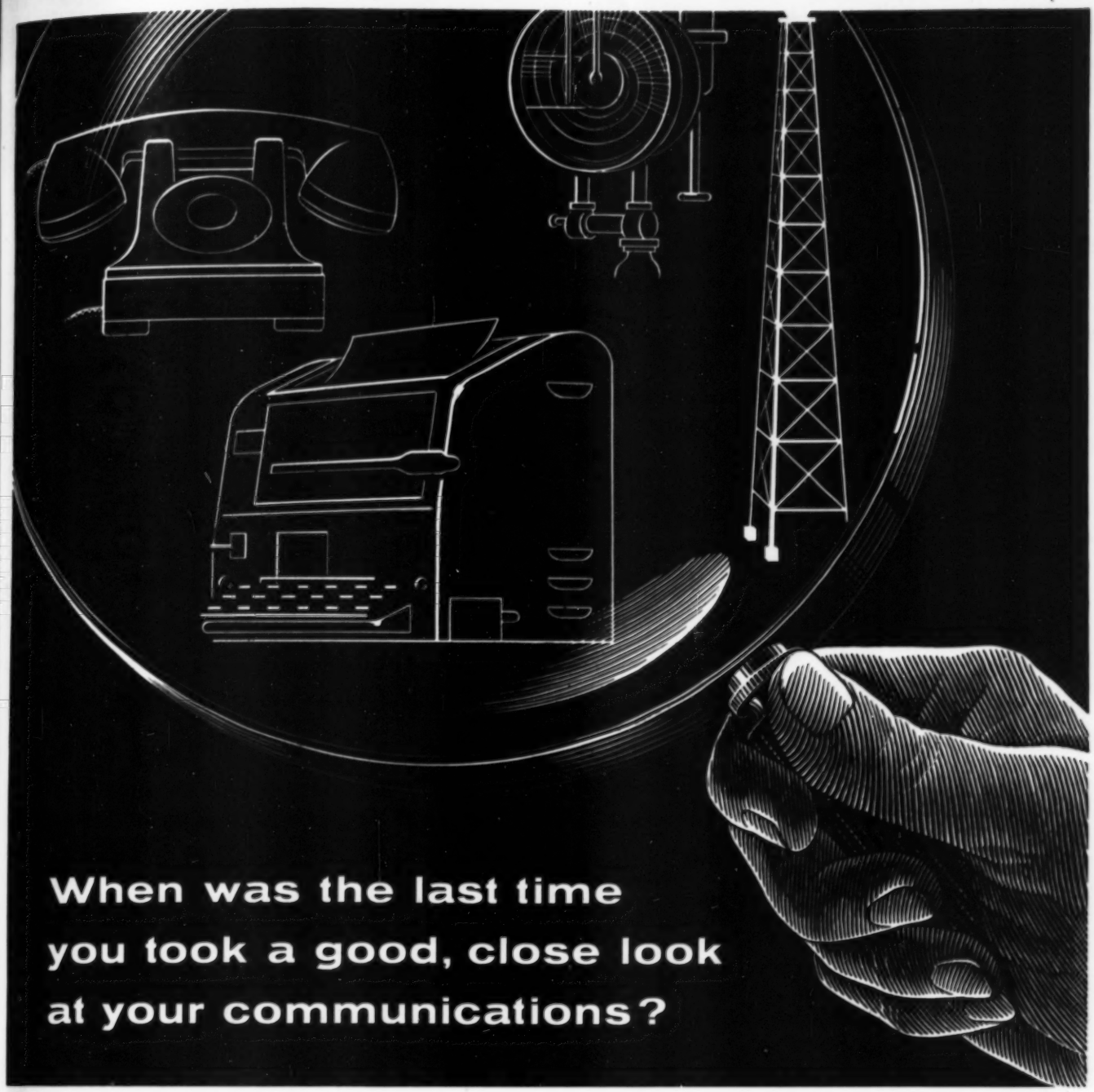

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year in wholesale rate increases proposed jointly by the company companies, making an increase of about $4.5 million. Subsequent to the filings, a merger was effected between the two companies, with Seaboard as the surviving company.

The FPC also suspended $1,025,455 wholesale gas rate increase by Kentucky West Virginia Gas Co., Pittsburgh; scheduled consolidated hearings on two suspended increases by New York State Natural Gas Corp., Pittsburgh; approved settlement of a South Jersey Gas Co. increase of $33,000 instead of the $52,000 applied for originally. Filings last month included Kansas-Nebraska Natural Gas Co.'s proposed $694,000 increase, which would affect five wholesale customers in Nebraska. East Tennessee Natural Gas Co.'s proposed $426,417 increase was rejected by the FPC last month, and its new rate schedule provides for a $132,939 increase.

Laurence Reid (center), organizer of the conditioning conference, discusses dew point recorder progress with J. B. Bird (left) and W. L. Yauger, both of United Gas.

Conditioning conference attracts more than 200

Following a pattern of easy, informal discussion set during past years, the University of Oklahoma's gas conditioning conference met again this year in Norman on March 16-17 to delve into the problems of gas processing. This year's conference, guided as in the past by Laurance S. Reid, chairman of Oklahoma's School of Natural Gas Engineering, continued its successful policy of round table discussion even though attendance stood at over 200 persons.

Formerly known as the gas hydrate control conference, the meeting was this year renamed the gas conditioning conference to more nearly describe its function. Specific sessions on separation and gas sweetening were added to the agenda whereas these matters were discussed in prior years only as they applied to hydrate control.

A round-table discussion on gas sweetening and related problems, moderated by Ovid Baker of Magnolia Petroleum of Dallas, who stood in for E. G. Hammerschmidt of Natural Gas Pipe Line Co. of America, was a part of the second day's program.

A progress report on field performance of the U. S. Bureau of Mines' dew point recorder was given by J. R. Bird and W. L. Yauger, both of the United Gas Pipe Line Co., as a sequel to last year's discussion of the instrument by W. M. Deaton of the

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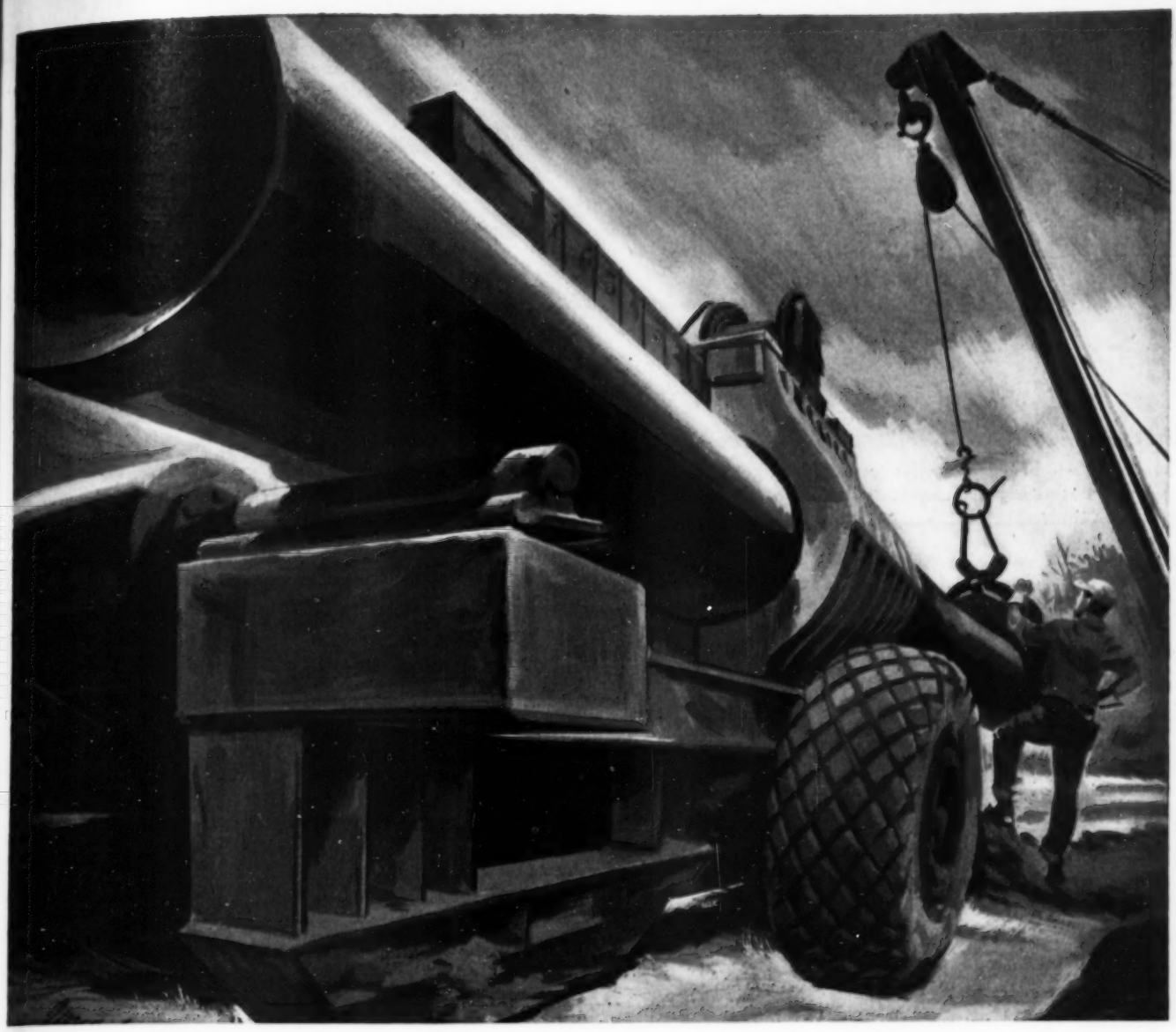

"on a big bender"

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From left: Ovid Baker, Magnolia Petroleum; John M. Campbell, Black, Sivalls & Bryson; and T. S. Bacon, Lone Star, all participated in the program.

bureau. Mr. Bird discussed the design and operation of the equipment, and pointed out some of the operating problems that have been encountered. He also told of the means that has been used by his company in the calibration of the device.

Mr. Yauger undertook a discussion of the practical application of the dew point recorder in a dehydration plant. He detailed with charts the method that is used to analyze and locate the cause of trouble when the recorder shows evidence of water in the line. He also told of the means by which the recorder can be used to check the characteristics of dehydration beds and various desiccants.

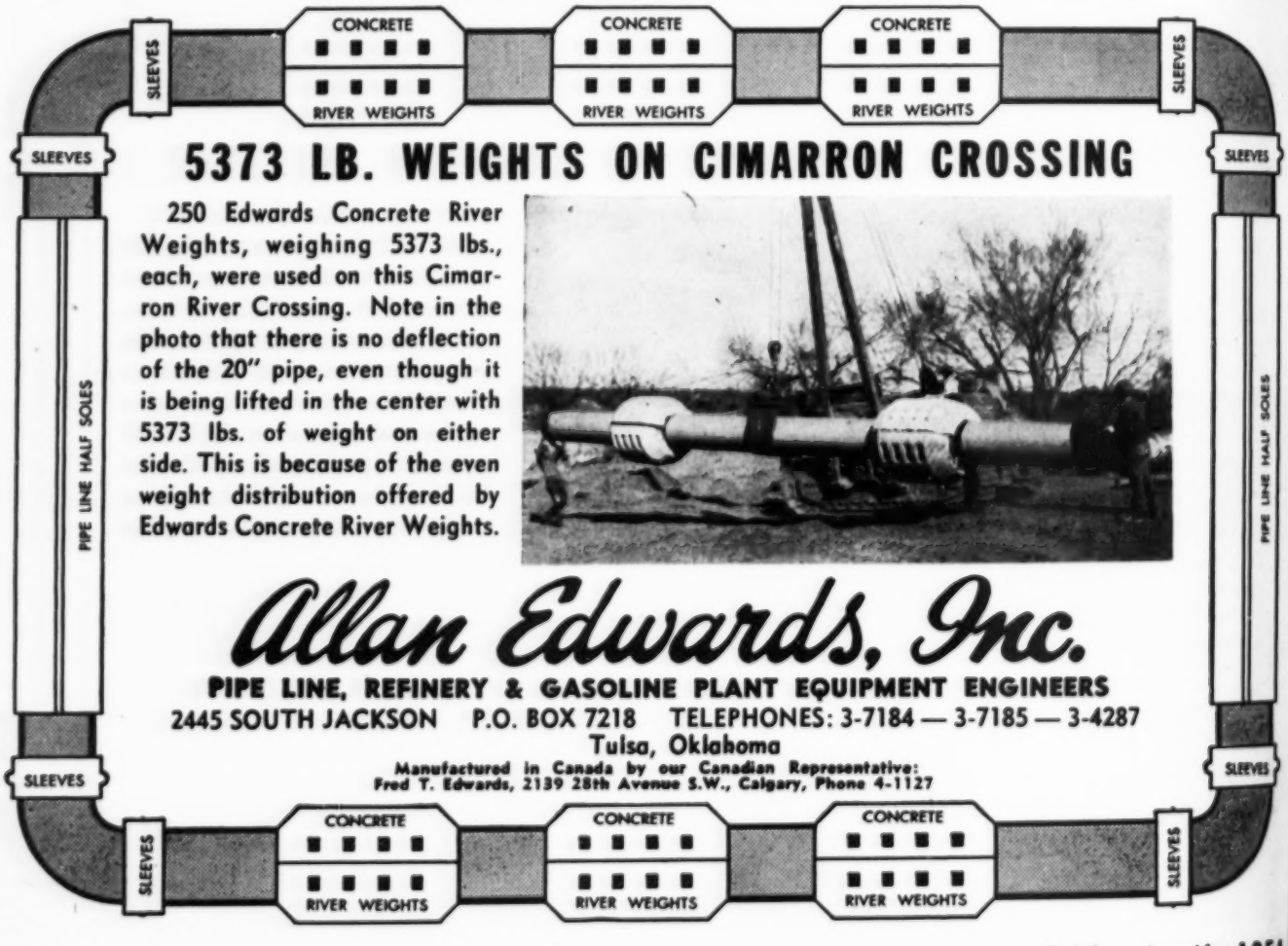
Mr. Deaton of the U. S. Bureau of Mines' helium plant at Amarillo, again appeared on this year's program, this time as moderator of a round table discussion on hydrate control and dehydration problems. The discussion was concerned with the peculiar qualities of hydrate formation and the methods that may be used for its prevention. Of particular interest were the problems presented by hydrate formation in certain gathering systems.

In setting the stage for the session on separation of liquids and solids from gas, T. S. Bacon of the Lone Star Gas Co., Dallas, emphasized the importance of gas cleaning equipment to the industry. He established the approach that must be made to gas cleaning and indicated how some of the problems might be solved through future developments in gas cleaning equipment. He indicated that serious engineering thought applied to the problem in the light of existing background on the behavior of particulates should produce results that will be constructive to the industry in the near future.

Texas legislature to meet for tax problem

Independent oil and gas producers in Texas believe a constitutional gas gathering tax (see March GAS, page 152) can be written as at least a partial solution to the state's tax problems, and such legislation was expected to be presented when the Texas Legislature convened last month at a special session.

M. D. Bryant, president of the Texas Independent Producers and Royalty Owners Association, speaking at an executive committee meeting of his group, said "Oil and gas producers already pay more than two-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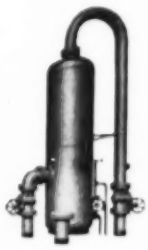

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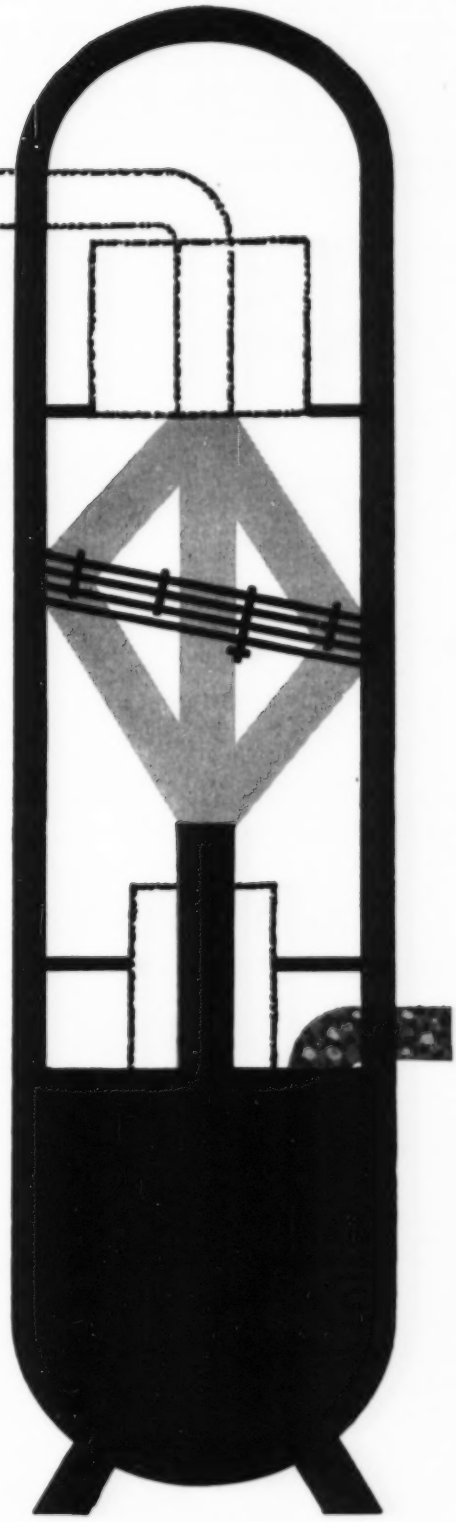

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thirds of the state's business and property taxes. If additional taxes are required from the natural gas industry, our studies indicate that they can be raised through a constitutional tax on gas gatherers, who so far have escaped their share of the gas tax burden."

A two-way plan has been outlined by Texas Governor Shivers: For basic, long-range financing, it was understood that he would favor a tax that would tap gas moving through the long-line pipelines. Because any new tax such as that would face a certain court test, tying up the income from it for an indefinite length of time, increases in existing taxes must be voted to provide immediately usable income. The immediate income would be derived from an increase in the Omnibus Tax Act, long the workhouse in the state's tax structure.

Portion of Little Inch to be reconverted

Studies conducted by Texas Eastern Transmission Corp. have indicated the feasibility of reconverting the major portion of the Little Inch pipeline to a petroleum products common carrier, according to George T. Naff, president of the company.

He added, however, that no reconversion is contemplated without first adding facilities necessary to insure continuance of the company's present natural gas capacity. Reconversion is also based on the assumption that the FPC will permit abandonment of natural gas service through portions of the 20-in. line and the substitution of other facilities for such service.

Heavy line shows 20-in. line to be converted.

As shown on the map, the reconverted 20-in. line could be used to deliver heating oils, gasolines, diesel oil or kerosene from Gulf Coast refineries to the Mississippi and Ohio river inland waterways through river terminals at Cape Girardeau and Moundsville or into shipper's tanks at any point along the line. In such service the line would be capable of handling up to 235,000 bbls of refined products per day.

The daily load of 200 MMcf of natural gas now carried by the 20-in. would probably be shifted to the company's present 30-in. line through the construction of some 216 miles of 24-in. line from Caston, La., to the southern terminus of the 30-in. line at Kosciusko, Miss.; the construction of about 113 miles of 16-in. line from Beaumont, Texas, to a point of intersection with the company's 24-in. Provident City-Castor pipeline near Lufkin, Texas, and the addition of compressor station horsepower at various points along the line.

It is estimated that the minimum construction necessary to reconvert the 20-in. to a products line and to provide substitute facilities to replace the capacity handled by the 20-in. would require an expenditure of about $76 million. Details of the exact manner in which alterations to the natural gas system would be made have not been completed.

New highs reached in Texas conservation

The Texas Railroad Commission's campaign to reduce flaring of natural gas showed results in 1953.

During January 1953 nearly 33 billion

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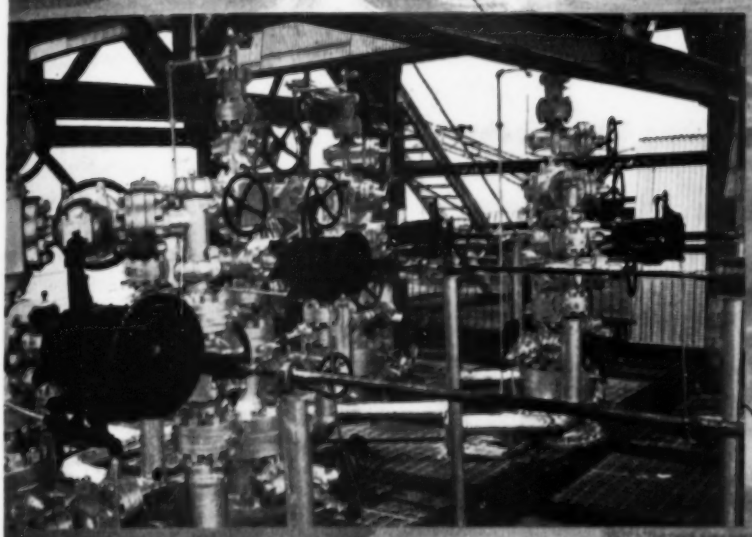

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HOT DOPE

Straight from the Kettle on PIPE PROTECTION

★

By Boyd Mayes

• Saw some place recently where one of those Oil writers said: "PIPELINING IS EVERYBODY'S BUSINESS." With this, we surely agree. We're not talking about just the side he was adding up — we're talking about the human side — how much benefit that gas pipelining has brought to all of us. Reckon there's a whole new generation growing that will never know what it is to chop kindlin' and tote wood for a kitchen stove or fireplace. They'll just light a match—turn on the gas —and there she glows—thanks to good pipelining—and progress. Another interesting thing recently noted is the amount of chemical pipelining. Folks would be surprised how much butadiene, styrene, chlorene, propylene, etc. pipelines carry under the Texas Gulf Coast. Yes, pipelining is big business and we are happy to be a part and offer our facilities to everyone who needs coating, wrapping and reconditioning service for pipe. We've been at it 26 years and have the best men in the business to handle it.

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cu ft of gas was burned in the field; this figure had been reduced to 21 billion by December. Most of the cut resulted from shutting down the Spraberry field, where flares were operating. The field was reopened in January with the completion of pipelines to gather the gas.

The state's total marketed gas production in 1953 was more than 4½ trillion cu ft, of which transmission companies bought almost 3½ trillion. Exports of natural gas from Texas totaled more than 2216 billion cu ft during the year, up 10.4% over 1952.

Pipeline building firm established in Denver

Harris Constructors Inc. has been organized in the Rocky Mountain area to specialize in the construction of gas and oil pipelines. G. R. Harris, Denver investment firm executive, will be president of the new company. Carl H. Breitwieser will be vice president and general manager.

Field offices for the new firm will be at 1340 S. Lipan St., Denver; executive offices are in the First National Bank Bldg.

Iroquois Gas Corp. seeks greater capacity, stability

Iroquois Gas Corp., Buffalo, N. Y., has filed an application with the FPC requesting authorization for the construction of approximately 24½ miles of 20-in. natural gas transmission pipeline in Erie county, N. Y. (Docket G-2369).

The proposed new line, estimated to cost $1,540,000, would extend from Iroquois' Porterville compressor station in Elma, N. Y., to a city gate mixing station in Tonawanda, N. Y. The new line would give greater capacity, stability and flexibility to the Iroquois distribution system by providing a direct supply of natural gas at the mixing station in Tonawanda for use both by Iroquois and by its wholesale customer at that point, Republic Light, Heat & Power Co., also of Buffalo.

Both Iroquois and Republic will have separate metering facilities and will own and operate separate mixing facilities at the mixing station to make 900 Btu mixed gas for retail customers.

Hearings under way on American Louisiana line

A request for a 30-day delay in the FPC hearings on the American Natural Gas System's proposed 1200-mile line (see February GAS, page 143) from southern Louisiana to Michigan was denied. The difficulties arose after American Natural submitted testimony on its long-term contracts with southern Louisiana producers for 250 MMcf gas daily. The company then presented testimony about 50 MMcf the proposed line would get from Texas Gas Transmission Corp. through a connection at Slaughters, Ky.

Texas Gas Transmission submitted written testimony on its reserves, but Harry Littman, Panhandle Eastern Pipe Line Co. attorney, said TGT should detail its own gas needs so it could be determined whether it has enough left to sell to American Natural. His request for the delay was denied and the hearing is proceeding.

Northern Natural gets okay to complete expansion

Northern Natural Gas Co., Omaha, has received FPC authorization to complete a proposed expansion of its pipeline system, already started, to enable it to deliver additional natural gas to existing customers and to supply several new customers in the Midwest commencing next winter.

The newly authorized facilities include approximately 204 miles of mainline pipe and 22,800 hp in mainline compressor additions. The cost is estimated at $23,776,000. Additional branch lines authorized for new service will cost approximately $14,689,057.

The project is the final phase of an expansion program that will increase Northern's total system capacity by approximately 300 MMcf daily, with the additional gas being received in Texas from Permian Basin Pipeline Co.

Last May, the commission authorized Northern to construct, but not to operate, part of the facilities covered by the application. This portion of the project included about 259 miles of line and a total of 50,400 hp in compressor capacity. It was designed to increase the system's capacity by 200 MMcf per day. Then, on Dec. 24, the FPC authorized Northern to operate the facilities already approved for construction, and allocated about 164 MMcf of gas a day to existing customers for the current winter. The recent authorization allocates the remaining volumes for delivery commencing next Jan. 1.

The over-all project as now approved, will increase the sales capacity of Northern's system by a total of about 278,680,000 cu ft of gas per day. The Dec. 24 order allocated about 163,753,000 cu ft of this, leaving 114,927,000 for allocation.

Northern has proposed to allocate 46,927,000 cu ft of the remaining gas to existing customers (including its Peoples division), the remaining 68 million to be for new customers. However, the commission sent 70,101,000 cu ft to new customers: 6,272,000 to Northern's Peoples division; and 38,554,000 to existing customers.

The commission rejected Northern's proposal to provide facilities to serve the new customers by a contribution, or "customer participation" plan, under which Northern would expand about $7 million for branch or lateral lines to serve certain new communities, most of which would make nonrefundable contributions towards the cost

Crude oil pipe line from Yale, Okla., to Borger, Tex. This is 10¾" Electric Weld Line Pipe.

Here's line pipe that goes in fast in the field

Field welding joints before ditching Electric Fusion Weld Gas Line from Petersburg, Ohio, to Cleveland, Ohio. Three 60-foot joints were field welded together before coupling.

Take that Electric Resistance Weld Line shown above. Or a big 30" Electric Fusion Weld Line, shown at the right. When they're made by Republic, they have one thing in common:

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struction. The FPC declared that this plan would not be in the public interest, and directed Northern to finance the branch lines entirely by itself, at an estimated cost of $14,689,057.

Commissioner Nelson Lee Smith, joined by Commission Draper, dissented in part on the principal ground that the majority had disregarded Northern's tariff—as prescribed by the FPC—by making available to Dubuque, Iowa, gas to which Northern's existing customers are entitled.

The separate opinion said that "to now provide that a somewhat reduced second-year requirement of natural gas may be available to Dubuque some two years hence, the majority has had to reduce, more or less arbitrarily, the estimated market requirements of certain of Northern's existing customers, and to do so in direct contravention of a contract-demand take-or-pay provision which has been part of Northern's tariff since 1947."

It pointed out that the FPC at that time had prescribed a step-by-step plan for controlling the allocation of additional increments of pipeline capacity in an orderly and equitable fashion, because Northern's system capacity had long lagged behind its customers' total requirements. "Yet here," the dissent declared, "instead of following these established procedures and permitting Northern's existing customers to satisfy their pent-up and long unsatisfied demands . . ., the majority disregards the tariff and completely reverses the order of service, first awarding gas . . . to the new customers . . . and then dividing what is left among Northern's existing customers, with the resultant inevitable reductions to some of them. . . ."

TGT'S insurance subsidiary has successful first year

Tennessee Gas Transmission Co.'s newest subsidiary, Tennessee Life Insurance Co., which will benefit the TGT family under the retirement income plan, either as pensions or for life insurance, has a combined capital, surplus and reserves of more than $7 million. The company believes this is the largest amount any life insurance company ever had in its second year of existence.

Gardiner Symonds, TGT president, heads TLI as board chairman and president. The board of directors are all either directors or officers of the parent company.

The insurance company was formed to conduct a life, health, and accident insurance business. One of its purposes was to provide coverage available to TGT'ers an associated companies' employees under TGT's retirement incline plan, and TLI now carries all the basic life insurance and pension coverage under this plan.

Steps are being taken so that Tennessee Life, now qualified to do business in the state of Texas, can qualify to do business in the other states through which TGT pipeline systems pass and in which the company has employees.

The firm has opened a Houston agency, its first, and other Texas agencies may be opened before the end of the year. Some 25 different plans of insurance are offered by the company: family protection; retirement income; mortgage insurance; education; juvenile insurance; and sickness and accident coverage. Rates are comparable with those of old-line companies.

FPC consolidates hearings for New York service

An application by Transcontinental Gas Pipe Line Corp., Houston, proposing the construction of pipeline facilities to enable it to increase natural gas deliveries in the New York City-New Jersey area (see March GAS, page 157), has been consolidated with the previously scheduled March 15 FPC hearings on several related applications — including one by Tennessee Gas Transmission Co., Houston, which is in competition with Transcontinental's.

The commission at the same time consolidated an application by New York State Natural Gas Corp., Pittsburgh, with the hearings. New York State Natural's application involves underground storage facili-

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New Light-weight, reinforced TRANSHIELD

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Stretching a distance of 200 miles from Mandan, N. D. to Moorhead, Minn., the new products pipe line will provide a valuable link connecting the new Mandan refinery with the mid-western products pipe line system of the Standard Oil Company (Indiana).

Permits high speed wrapping... assures effective protection for enamels

On the job shown above, coating and wrapping rates up to 17,000 feet per day were reported. This remarkable record is a tribute to Transhield's special tear-free reinforcement. This reinforcement is accomplished through the use of continuous glass yarns, parallel spaced on ¼" centers.

Designed for average soil conditions, Transhield is a light-weight felt composed of coal-tar saturated asbestos. This time-tested material assures an efficient barrier between pipe line enamels and earth loads . . . soil stresses.

As an outer sheath to retard cold flow, Transhield takes advantage of the full thickness of the enamel coating—working effectively toward preserving a continuous film of enamel on the pipe line.

Long-Length Rolls—Available in 800-ft. rolls (14" O.D., 2" I.D.) for traveling power-driven coating and wrapping machines. Other lengths can be furnished to suit your method of application. Widths are from 2" to 36".

Johns-Manville has developed three wrapping materials for pipe line protection:

J-M 15-lb. Asbestos Pipe Line Felt (perforated or unperforated)—for severe soil conditions.

J-M Transhield Asbestos Pipe Line Felt—for average soil conditions.

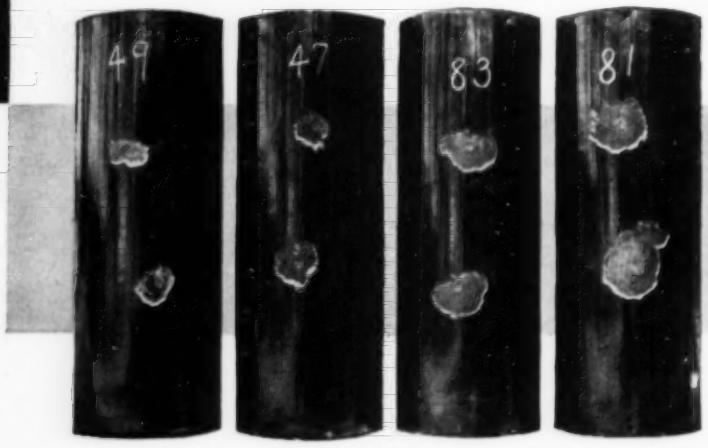
J-M Trantex polyvinyl pressure sensitive tape—for pipe line corrosion protection where ease of application is important such as when coating field joints of mill-wrapped pipe or making emergency pipe line repairs.

For further information write Oil Industry Department Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville ASBESTOS PIPE LINE FELT

FIRST STEP IN CORROSION CONTROL IS BOND OF COATING MATERIALS AT spi



Maximum bond of the coating materials, which is the first step in corrosion control, is obtained with steel grit cleaning . . . a better bond than is obtainable with any other conventional method of cleaning pipe, including mechanically operated knives and/or brushes.

These specimens of coated pipe, a part of many hundreds tested, using identical coating materials and procedures, were impacted according to A. S. T. M. standard methods.

Pipes No. 49 and No. 47 were steel grit cleaned . . . pipes No. 83 and No. 81 were mechanically cleaned with knives and wire brushes . . . all were impacted with a 650 gram steel ball dropped from a height of 8 feet. The steel grit cleaned pipe had less than one third (1/3) of the materials removed, compared to the pipe that was mechanically cleaned.

Only at Standard Pipeprotection Inc., is every length of pipe cleaned with steel grit. Two Wheelabrators, one for 3/4" to 6" and one for 6" to 20" pipe, clean your pipe for better bond.

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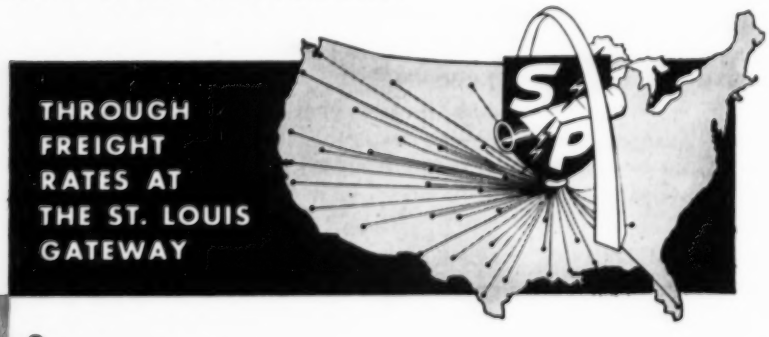

standard pipeprotection inc.

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ties in the Harrison storage pool in Steuben and Potter Counties, N. Y.

The commission's new order changed the hearing procedure so that the New York State Natural application would be heard immediately after the application of Tennessee and Iroquois Gas Corp. This was to be followed by examination of witnesses appearing in connection with the other applications, except Transcontinental's, which will be heard last.

As previously scheduled, the March 15 hearings were on five applications, all involving Tennessee. Two were filed by Tennessee jointly with other companies, and the fifth was by a public utility district seeking gas from Tennessee.

The hearings also involve joint applications by Tennessee and Iroquois Gas Corp., Buffalo, N. Y., and by Tennessee and New York State Natural, both relating to the development of underground gas storage facilities. Of the remaining two applications, one is by Tennessee proposing to utilize unallocated capacity to transport natural gas for the account of Equitable Gas Co., Pittsburgh, and the other is by the West Tennessee Public Utility District of Weakley, Carroll and Benton counties, Tenn., seeking a supply of gas from Tennessee.

Permian's $42 million program completed

Permian Basin Pipeline Co.'s $3 million carbon dioxide removal plant in Pecos county, Texas, has been completed and is now on the line.

This marks the completion of the entire $42 million construction program of Permian which kicked off in June of 1952. Permian's pipeline system, built in the Permian Basin of New Mexico and Texas, includes four compressor stations, one located in Lea county, New Mexico, and three in the Spraberry Trend of Texas; two dehydration plants, one sulfur removal plant, gasoline plant, carbon dioxide removal plant, and 234 miles of pipeline.

The Mitchell Plant in Pecos county will permit processing 25 MMcf of natural gas daily during the first year of operations with provisions to expand capacity to 150 MMcf daily. It is one of the largest plants of its kind to be found in the country.

Construction of the plant was necessary because of the high content of carbon dioxide found in gas in that area. Removal of the carbon dioxide also aids in preventing corrosion of pipelines when the gas is transmitted.

Stearns Rogers Engineering Co., Denver, Colo., was the contractor for the work at the Mitchell plant. Howard Spear is superintendent of the plant.

Sixteen company cottages were constructed at Mitchell to house Permian personnel. Children of employees living at the Mitchell plant attend school in Fort Stockton. The Fort Stockton school board agreed to serve the Mitchell plant and surrounding ranches

The school furnishes a bus to pick up the youngsters each school morning and return them in the evening. This is reported to be one of the longest school bus routes in the state, with a daily drive of 84 miles.

Approximately 67 miles of 20-in. pipe, connecting the Mitchell plant with Permian's Plymouth compressor station in Reagan county, has been completed and an additional eight miles of gathering lines, varying in size from 4½-in. to 16-in. have also been completed. These lines, when put in service, marked the completion of 234 miles of pipeline system, including 30-in. large diameter pipe. R. H. Fulton & Co., Lubbock, Texas, was the pipeline contractor.

Permian Basin Pipeline, a subsidiary of Northern Natural Gas Co., sells its gas to Northern. In terms of capacity it means an additional supply of gas for Northern of 200 MMcf per day during the first year of Permian's operation and still another 100 MMcf daily during the second year.

Northern's capacity by the end of 1954 will have increased by more than 400% since 1944 when it will reach 1110 MMcf per day, compared to only 243 MMcf in 1944.

Fort Smith receives FPC sanction for transfer

The FPC has approved an application by Fort Smith Gas Corp. to acquire certain of the natural gas facilities of Arkansas-Oklahoma Gas Co. The commission concurrently granted an application by Arkansas-Oklahoma for authority to sell and transfer its facilities to Fort Smith. Both concerns have main offices in Fort Smith, Ark.

Through the transaction, Fort Smith will acquire from Arkansas-Oklahoma 61.2 miles of gathering lines, 236.9 miles of transmission lines, 231.6 miles of distribution mains and 207,000 ft of customers' services. The facilities will be used by Fort Smith to transport and distribute natural gas in Sebastian, Crawford, and Franklin counties, Arkansas, and in LeFlore and Sequoyah counties, Oklahoma.

Purchase of the facilities amounts to approximately $1,938,000, depreciated original cost.

Both the Arkansas Public Service Commission and the Corporation Commission of the State of Oklahoma have approved the transaction.

El Paso Natural hopes to get 56 MMcf additional

El Paso (Texas) Natural Gas Co. has filed an application with the FPC (Docket G-2317) requesting authority to construct pipeline facilities in Lea county, New Mexico, which will enable it to acquire up to 56 MMcf of additional natural gas per day in the Permian Basin area.

Estimated to cost $3,295,589, the project

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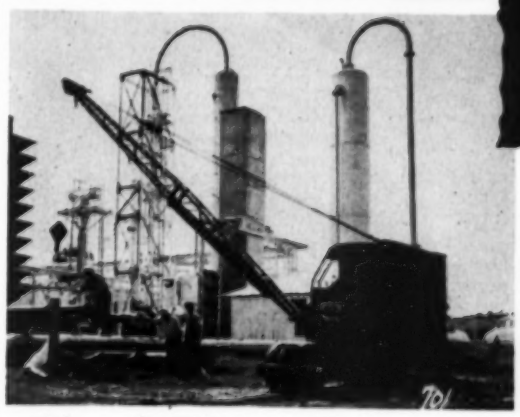

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also will permit El Paso to achieve a greater flexibility in operation of its pipeline facilities in the area.

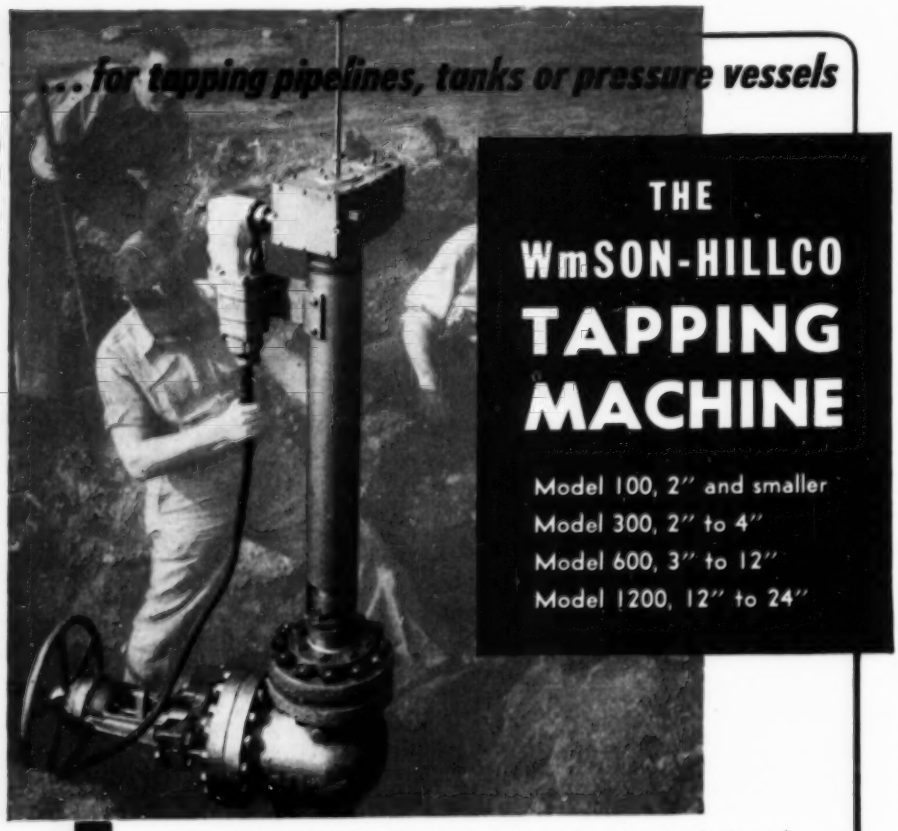
Construction would include a total of 13.3 miles of line; 1540 hp in compressor capacity; a purification and dehydration plant to be known as the Monument treating plant; and metering facilities. The project would permit El Paso to transport from its proposed treating plant up to 110 MMcf of gas per day to its existing Dumas transmission pipeline, to take an additional 25 MMcf, which is now being sold to Cabot Carbon Co. in the Monument area; and to increase by 24 MMcf per day the gas now being taken from Gulf Oil Corp.'s plant in the Waddell or Sandhills area.

PG&E plans 700 MMcf daily capacity before next winter

Preliminary work for the installation of 107 miles of 34-in. pipe is under way by Pacific Gas & Electric Co., San Francisco, which will result in PG&E increasing its out-of-state gas supply to 700 MMcf a day before next winter.

On the Mojave desert earth-digging equipment is working along an 80-mile route from Newberry eastward to Danby, preparing a trench paralleling that section of PG&E's 502-mile Super Inch line, which extends from the Arizona-California border to Milpitas, at the southern end of San Francisco Bay. When the 80-mile job is completed, the equipment will be moved into the hills near Hollister, where a 27-mile installation will be made.

Completion of the two jobs will raise the company's cost for the Super Inch to $98,740,000, according to Norman R. Sutherland, vice president and general manager of PG&E.



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Pipeline Notes

The Supreme Court will hear arguments in the Phillips case during the week of April 5. Inasmuch as the Court customarily adjourns for the summer early in June, it cannot be determined at this time whether the court will render its decision in the case before it takes its summer adjournment. If it doesn't, the decision will not be rendered before October.

Plans are being considered for the merger of Natural Gas & Oil Corp., Shreveport, with its parent organization, Mississippi River Fuel Corp., St. Louis.

Shenandoah Gas Co., Lynchburg, Va., has received FPC authorization (Docket G-1448) to construct about 40 miles of line to supply markets in northern Virginia and northwestern West Virginia. The $1½ million project would connect with Atlantic Seaboard Corp.'s facilities near Middletown, Va., and extend up through the Shenandoah valley, via Winchester, Va., to Martinsburg, W. Va., where it would connect with the existing distribution system of Martinsburg Gas & Heating Co.

The town of Murfreesboro, county seat of Pike county, Arkansas, has asked the Arkansas Public Service Commission for authority to construct a natural gas transmission line and distribution system to serve the city. Estimated cost of $240,000 would be financed by a bond issue, and the property would be leased to the Arkansas Louisiana Gas Co. on completion.

Pipeline Coating & Engineering Co. Inc. has moved into larger quarters in Los Angeles. With 7000 sq ft of additional floor space, the new location provides not only a greater volume of production, but expanded engineering facilities as well.

East Tennessee Natural Gas Co., Knoxville, has received FPC authority to sell a maximum of 9 MMcf of natural gas per day on an interruptible basis to Bowaters Southern Paper Corp. for use in its plant now being constructed near Calhoun, Tenn. East Tennessee will construct the necessary metering and regulating equipment to make the sale to Bowaters.

Pipeline People

JAMES R. HUTTON is the sales engineer for the newly established Shreveport sales office of Clark Bros. Co., which has been opened to better serve compressor users of sections of Texas, Arkansas, Louisiana, and Mississippi.

J. R. Hutton
Clark..Bros.

H. J. Upchurch
Texas Eastern

HADEN J. UPCHURCH, land department manager for Texas Eastern Production Corp., has been elected a vice president. He will continue to manage the activities of the land department.

A. L. PEAKE JR. has been appointed assistant sales manager, southern district, Los Angeles, and A. G. GREY, as assistant sales manager, central district, Oakland, by Kaiser Steel Corp.

GARDINER SYMONDS, president of Tennessee Gas Transmission Co., Houston, has been elected to the National Industrial Conference Board.

HORRALL HARRINGTON has been named sales engineer for the midwest district by the Chemical Plants division of the Blaw-Know Co. He will headquarter in Chicago.

LOUIS F. FRAZZA has become manager of the direct sales operations of the newly established marketing section of Johns-Manville Corp.'s transit pipe department, with OTTO A. WIRSIG as staff manager. EDWARD C. KOCH is manager of dealer sales operations with JAMES R. ALLEN JR. as staff manager.

JOHN L. LOEB has been elected a member of the board of directors of the Gulf Interstate Gas Co., Houston.

LEWIS M. SCHOTT, a vice president of Merritt-Chapman & Scott Corp., New York, has been elected a member of the company's board of directors.

ROBERT S. BAUMAN is now division superintendent of the Manufacturers Light & Heat Co.'s transmission, production, and storage operations in southwestern Pennsylvania. He will be assisted by HARRY T. HEUPLE. Their offices are in Washington, Pa.

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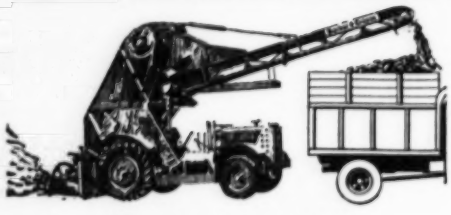

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Progress Reports

NEW CONSTRUCTION PLANNED

COLORADO-WESTERN PIPELINE CO., Denver. For 328-mile line from southwest Colorado to serve Denver, Pueblo, and Colorado Springs; 220 miles of 18-in. and 108 miles, 16-in.

EL PASO (TEXAS) NATURAL GAS CO. Docket G-2371 for 13.3 miles of line, 1540 hp compression, purification and dehydration plant, and metering facilities in Lea county, N. M.

IROQUOIS GAS CORP., Buffalo, N. Y. Docket G-2369 for 24½-mile, 20-in. line in Erie county, N. Y., to extend from compressor station in Elma to city gate station in Tonawanda, N. Y.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-2361 to construct 24 miles, 16-in. line in south Louisiana; add 2000-hp compressor unit at Bastrop, La.; and build purchase meter station in south Louisiana.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-2367 for 421 miles of 30- and 36-in. loops and 15,600 hp in new and existing compressor stations in Texas and Louisiana. Line to parallel sections of existing system in Louisiana, Mississippi, Alabama, Georgia, North and South Carolina, Virginia, and Maryland.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-2368 for 57 miles of line parallel to existing system in Louisiana, Mississippi, and Alabama.

CURRENT CONSTRUCTION

EL PASO NATURAL GAS CO. Docket G-2106. Work continuing on gathering lines, purification facilities and compressor plants totaling 161,860 hp to carry gas from Permian and San Juan basins. Contractors are Oklahoma Construction Co., R. H. Fulton Co., Western Pipe Construction Inc. and company's own crews. All facilities to be in operation by November 1954.

EQUITABLE GAS CO., Pittsburgh. Docket G-2130 to activate the Logansport storage field in the Big Injun Sand, Marion county, W. Va. Installation of a 1320-hp compressor station in Wetzel county remains to be completed in the spring.

GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 860 miles of 30-in. line from Rayne, La. to Boyd county, Ky., 229 miles lateral lines and five 8000-hp compressor stations in four states. Mainline contracts let to H. C. Price and Houston Contracting Co. Lateral line contracts let to Anderson Bros., Associated Pipe Line Contractors and Williams Bros. Parkhill Truck Co. hauling pipe. Expect completion Nov. 1, 1954. Over 700 miles of 30-in. line completed. Work under way on 313 miles of gathering lines.

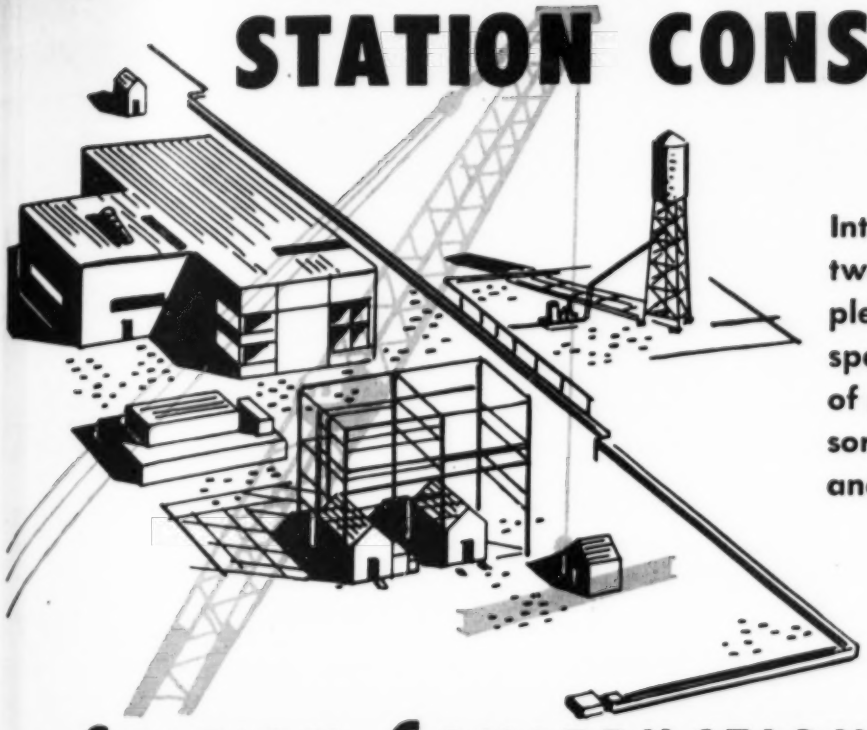
MISSOURI PUBLIC SERVICE CO., Warrensburg. Mid-States Construction Co. was cheduled to begin work March 15 on 25 miles of 10-in. line from Warrensburg to Clinton.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket No. 2212 for 11 miles of 24-in. line to serve steam electric plant near Pittsburg. Scheduled for completion 1954. Company forces constructing.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-2101 to build about 200 miles of 34-in. mainline loops and 2500 hp in compressor capacity on line from Topock, Ariz. to a point near Milpitas, Calif.; and 7.2 miles of 30- and 34-in. and 1.9 miles of 22- and 24-in. line between Milpitas and Irvington, Calif. Pipeline work under contract to Engineers Ltd. Pipeline Co. Compressor under contract to Bechtel Corp. Entire job expected to be completed in 1954.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907. About 250 miles various size line and 4400 hp compression remaining for

STATION CONSTRUCTION



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construction in 1954 and 1955. Construction expected to begin March 15.

APPROVED

NORTHERN NATURAL GAS CO., Omaha. Docket G-2063 (in part-second year program) for 20 miles of 24-, 26-, and 30-in. mainline additions to connect with Permian Basin Pipe Line Co. system, and 22,800 hp in new and existing stations in Texas, Oklahoma, Kansas, Nebraska, Iowa, Minnesota, and South Dakota.

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va.

New Products

For additional information on these products use coupon on p. 114.

15 Backfiller

A one-man-operated, fast moving, big-capacity backfiller for pipelines and heavy construction work has been introduced by the Cleveland Trencher Co.

The new machine, Model 190, employs a 7-ft backfill board, backfilling as it travels, and providing continuous operation under one-man control.

The 190 has a low ground bearing pressure—6.2 lb per sq in. sprockets, wheels and rollers are utilized. Overall width of the new machine is 8-ft, not including the boom.

The machine has double-rimmed sprockets, wheels and rollers—anti-friction bearing mounted—eliminating track packing and effecting greater stability.

Cleveland Trencher Co.

Trade Literature

16 Corrosion Catalog

Cathodic Protection Service has available its 1954 illustrated catalog and price list covering over 700 individual items used by the corrosion engineer. In addition to materials, instruments, ditching machines and pipe coating materials, there are 14 pages of technical data to assist in determining materials and current requirements in cathodic protection installations.

Cathodic Protection Service

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17 Pipelaying Booklet

The importance of control, teamwork, dependability, and safety in machines working on pipeline spreads is discussed in a new booklet from Caterpillar Tractor Co. Entitled "Here's Why You Find Cat-Built Machines on So Many Spreads," the booklet includes photographs of diesel-powered equipment in pipelaying operations.

Caterpillar Tractor Co.